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OGDEN AIR LOGISTICS CENTER HILL AFB UT PROPELLANT
ANALYSIS LAB E M DALABA AUG 82 MANPA-473(82)

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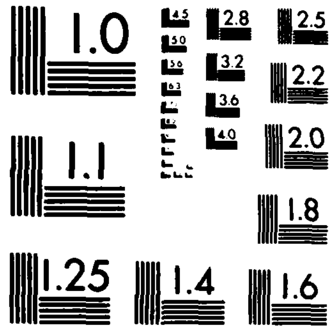
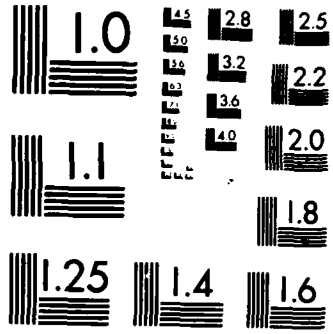


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963 A



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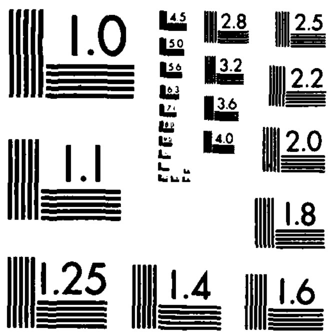

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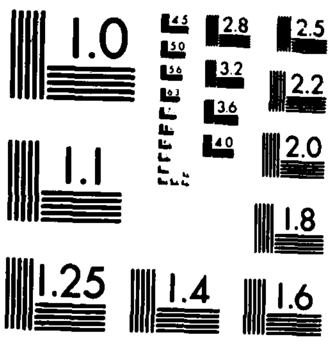

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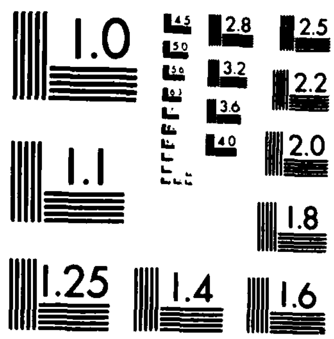

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

HEADQUARTERS
OGDEN AIR LOGISTICS CENTER
UNITED STATES AIR FORCE
HILL AIR FORCE BASE, UTAH 84056

PROPELLANT SURVEILLANCE REPORT ANB-3066 PROPELLANT

PROPELLANT ANALYSIS LABORATORY

MANPA REPORT NR 473(82)

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MANPA REPORT NR 473(82)

PROPELLANT SURVEILLANCE REPORT

ANB-3066 PROPELLANT

Author

Elizabeth M. Dalaba

ELIZABETH M. DALABA, Chemist
Component & Combustion Test Unit

Engineering & Statistical Review By

Glenn S Porter

GLENN S. PORTER, Project Engineer
Engineering & Reliability Branch

Dan L. Petersen

DAN L. PETERSEN, Mathematician
Data Analysis Unit

Recommended Approval By

L. A. Brown

LEONIDAS A. BROWN, Chief
Component & Combustion Test Unit

Approved By

Dan L. Petersen for A. J. Inverso

ANTHONY J. INVERSO, Chief
Propellant Analysis Laboratory

August 1982

Directorate of Maintenance
Ogden Air Logistics Center
United States Air Force
Hill Air Force Base, Utah 84056

ABSTRACT

This report contains test results from LGM-30 F and G, Stage II and Stage III propellant. Data are shown in regression plots, special types of plots such as those of gradient stress relaxation and constant load testing. Occasionally, data are presented in tabular form.

The differences between polymers used in the propellant are given in the analysis of covariance tables. Graphically, the differences are most evident in gradient stress relaxation modulus.

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REFERENCES

Report Nr	Title	Date
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MAGCP 111 (67)	ATP Test Results LGM-30 Stage II Propellant Wing VI, Phase I	1 Dec 67
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0162-06-SAAS-18	Ten Year Aging and Storage Program Wing VI Minuteman Second Stage	18 Aug 77
0162-06-SAAS-19	Motors and Components Program Progress	19 Feb 78
0162-06-SAAS-20		20 May 78
0162-06-SAAS-22	Appendix A included	May 79
0162-06-SAAS-24		Apr 80
	Appendix A	May 80
0162-06-SAAS-25		Nov 80
0162-06-SAAS-26		May 81
0162-06-SAAS-27		Nov 81

GLOSSARY OF ABBREVIATIONS AND TERMS

Aging Trend	A change in properties of performance resulting from aging of material or component
ANA	Aerojet Propellant, Stage III (ANB 3066 Formulation)
ANT	Thiokol Propellant, Stage III (ANB 3066 Formulation)
ANB	Aerojet Propellant, Stage II (ANB 3066 Formulation)
ASPC	Aerojet Strategic Propulsion Co.
CSA	Cross Sectional Area
DB	Dogbone
Degradation	Gradual deterioration of properties or performance
E	Modulus (psi), defined as the slope of the line drawn tangent to the initial linear portion of the curve
EB	End Bonded
EGL	Effective Gage Length
e_m	Strain at Maximum Stress (in/in)
e_r	Strain at Rupture (in/in)
"F" ratio	The ratio of the variance accounted for by the regression function to the random unexplained variance. The regression function having the most significant "F" ratio is used for plotting data. The ratio is also used in detecting significant changes in random variation between succeeding time points.
JANNAF	Joint Army, Navy, NASA, Air Force Committee
MANPA	Propellant Laboratory at OOALC
OOALC	Ogden Air Logistics Center
Post Curing	Period up to 12 - 16 months after manufacture

GLOSSARY OF ABBREVIATIONS AND TERMS (CONT.)

Regression	The general form of the regression equation is $Y = a + bx$
Regression Line	Line representing mean test values with respect to time
S_b	Standard error of estimate of the regression coefficient
S_e or $S_{Y.X}$	Standard deviation of the data about the regression line
S_m	Maximum Stress (psi)
S_r	Stress at Rupture (psi)
Standard Deviation (S_y)	Square root of variance
Strain Rate	Crosshead speed divided by the EGL
Thiokol	Thiokol/Wasatch Division
"t" Test	A statistical test used to detect significant differences between a measured parameter and an expected value of the parameter (determines if regression slope differs from zero at the 95% confidence level)
Variance	The sum of squares of deviations of the test results from the mean of the series after division by one less than the total number of test results
3 Sigma Band	The area between the upper and lower 3 sigma limit. It can be expected that 99.73% of the inventory represented by the test samples would fall within this range assuming that the population is normally distributed.
90-90 Band	It can be stated with 90% confidence that 90% of the inventory represented by tne test samples would fall within this range assuming that the population is normally distributed.

SECTION I

INTRODUCTION

A. PURPOSE:

The purpose of testing ANB-3066 propellant, used in Minuteman II Stage II and Minuteman III Stage II and Stage III, is to monitor and evaluate aging effects on this propellant which will contribute to the operational motor serviceability prediction. Testing was performed according to General Test Directive GTD-2C, Amendment 1, and MMWRBA Project M14058C.

B. BACKGROUND:

Service life testing of ANB-3066 carton propellant from Aerojet production began at Ogden ALC in 1966. When production for Minuteman III Stage III was transferred to Thiokol, the propellant samples from both Aerojet and Thiokol were tested. As lined cartons were produced, these were tested adding propellant liner bond specimens to the program. This report contains data from all these sources for propellant aged 13 to 178 months.

Significance tables for aging trend lines are given in the respective sections of this report.

Statistical techniques used are described in Section III.

Very low rate tensile, high rate tensile and stress relaxation tests are those most nearly related to conditions existing in the motor under storage, transportation and handling and booster flight.

Low rate uniaxial tensile tests and hardness are routine tests for all propellant. This report includes these data. Strain dilatation and cohesive tear energy tests have been applied to only a portion of the

cartons. Strain dilatation data are included in this report; cohesive tear energy will be included in the next report.

C. SUMMARY:

1. Unlined cartons show a significant increase in strain capability at very low rate. Although there is a significant decrease for lined cartons the alert limit will not be reached for approximately 10 years at the present rate of decrease.

2. ANT-P lined cartons show a statistically decreased strain capability when tested under high pressure and high strain. Alert limit may be reached in 10 years.

3. Constant load shears at 100 minutes have already fallen below the 15.4 psi alert limit for storage. Individual cartons have already failed the 23.1 psi alert limit for storage for constant load tensile.

SECTION II

TEST PROGRAM

Cartons representing raw material combinations were subjected to a random selection process designed to test all material lots within a two year-four test periods interval. When propellant cartons have been aged one year. they are added to the test program. Latest acquisition of Stage II was manufactured Dec 17, 1978, and Stage III manufactured April 4, 1977.

Propellant cartons are identified by source of manufacture. Stage II and III propellant manufactured by Aerojet Strategic Propulsion Company is identified as ANB and ANA respectively. Thiokol Company Stage III propellant is identified as ANT. All regressions use this nomenclature as well as additional information as to the type of carton, lined or unlined. Symbols are used on multiple regressions to separate types. There were two suppliers for polymers for Stage II propellant, "G" polymer manufactured by General Tire and Rubber and "P" polymer for Phillips. In this report the two polymer types have been treated statistically.

Lined and unlined cartons of ANB and ANT have been combined in regression analysis for comparison purposes and cover the time span from 13 through 178 mo.

The physical-mechanical tests which relate directly to stress analysis are limited. Very low rate tensile test data is related to storage conditions, and high rate rails tested under pressure relate to ignition. Stress relaxation modulus also relates to storage conditions. The thermal coefficient of linear expansion reflects some of the thermal stress to which the motor is exposed.

SECTION III
STATISTICAL ANALYSIS

Test data from physical and chemical tests of ANB-3066 propellant and from casebond test specimens have been analyzed statistically to determine whether aging trends exist. ANB-3066 propellant was categorized according to the manufacturer and the polymer type used in manufacture of the propellant. Two polymers were used. They are G-polymer produced by General Tire and Rubber and P-polymer produced by Phillips. For convenience in data analysis, the following code designations were used:

Manufacturer and System Application	ANB-3066 Code	Polymer Code
Aerojet: MINUTEMAN III Stage 2	ANB	G and P
Thiokol: MINUTEMAN III Stage 3	ANT	P

Test specimens were machined from two types of cartons, lined and unlined. The lined cartons have simulated case liner along one surface. The cartons are also subdivided according to lot.

Casebond test specimens are taken from lined cartons. For casebond shear or casebond tensile testing, a sampling of approximately 11 shear or tensile specimens can be taken from a carton. For each carton sampling, different weights are attached to the individual specimens with the intent to cause failure over a range of one to 100 minutes. The specimen data in each carton sampling is subjected to regression analysis with the times to failure regressed against stress. From these carton regressions were calculated one minute and 100 minute stress values, see Tables 8-1 to 8-6. From each carton regression, with the exception of those having low correlation coefficients, derived one minute and 100 minute stress values were used to form a set of aging regressions, see Figures 8-1 to 8-8. Outlier

data were also excluded from these regressions. The final analysis was to form multiple regression analyses from original specimen data, see Table 8-7. From these multiple regression analyses were formed Charts 1 to 6 from which times to failure at specific alert limits can be matched with carton age where 5% or 50% failure limits are given. These determinations should parallel the progress of casebond failure in field motors.

Additional liner bond test data are contained in Tables 8-8 and 8-9 and a summary of regression parameters pertaining to these data are in Table 8-10.

Linear regression analysis, of the form $Y = a + bX$, was usually used in evaluating data trends for most kinds of propellant tests. Where plots are presented, the variance about the least squares trend line is used to compute a tolerance interval such that at the 90% confidence level 90% of the sample distribution falls within this interval. This tolerance interval is extrapolated 24 months past the age point corresponding to the oldest specimen tested. Outer dashed lines marking a three standard deviation limit from regression are also given. The statistical significance of the slope of the trend line is evaluated for each regression plot. If significant, it is an indication that change over time is occurring.

Statistical data from regression analyses of similar test parameters were subjected to analysis of covariance to determine whether test data differences existed due to propellant manufacturer, polymer type, or kind of carton, lined or unlined. For each series of propellant tests such as tensile at 0.0002 inches per minute or stress relaxation, there is a corresponding analysis of covariance comparison of regressions. These tables are included in their respective sections. These analyses of covariance compare variances, slopes, and elevations of regression data. If no statistical difference is found between two sets of regression data, then the

two data sets can be combined into one regression analysis which has been done in a few cases. Where such has been done, the plotted regression data are differentiated through the use of different symbols.

SYMBOLS USED ON MULTI-SYMBOL REGRESSION PLOTS

000	ANA G Unlined	□
001	ANB G Unlined	○
002	ANB G Lined	△
003	ANT P Unlined	+
004	ANB P Lined	×
005	ANT P Lined	◇

SECTION IV

VERY LOW RATE TENSILE

LOW RATE TENSILE

A. Very Low Rate Tensile:

This test uses a 1/2 inch thick (1.27 cm) JANNAF dogbone. The specimens are tested at a crosshead speed of 2×10^{-4} in/min (8.5×10^{-6} cm/sec), 77°F (25°C) and ambient RH. Very low rate tensile testing is related to strain capability for storage at 60°F.

Lined cartons show a statistically significant decrease in strain at rupture (Table 4-1). Maximum stress is generally statistically increased (exception ANT "P:). Modulus is also significantly increased.

Unlined cartons show a statistical increase in strain at rupture. Modulus shows a significant decrease (ANT "P" being the exception).

Lined cartons show lower standard deviations than unlined cartons.

B. Low Rate Tensile:

This test utilizes the same type specimen as very low rate. Crosshead speed of 2 in/min (8.5×10^{-2} cm/sec), 77°F (25°C), and ambient RH are the test conditions.

TABLE 4-1

VERY LOW RATE TENSILE

Significance of Regression Slopes

System	Sm	Fig	er	Fig	E	Fig
ANB G Unlined	NS	4-1	Sig inc	4-2	Sig dec	4-3
ANB P Unlined	NS	4-4	Sig inc	4-5	Sig dec	4-6
ANT P Unlined	Sig inc	4-7	Sig inc	4-8	Sig inc	4-9
ANB G Lined	Sig inc	4-10	Sig dec	4-11	Sig inc	4-12
ANB P Lined	Sig inc	4-13	Sig dec	4-14	Sig inc	4-15
ANT P Lined	NS	4-16	Sig dec	4-17	Sig inc	4-18
ANB G & P Lined	Sig inc	4-19	Sig dec	4-20	Sig inc	4-21

TABLE 4-2

LOW RATE TENSILE

Significance of Regression Slopes

System	Sm	Fig	er	Fig	E	Fig
ANB G Unlined	Sig dec	4-22	Sig inc	4-23	Sig dec	4-24
ANB P Unlined	NS	4-25	NS	4-26	Sig inc	4-27
ANT P Unlined	Sig inc	4-28	Sig dec	4-29	Sig inc	4-30
ANB G Lined	NS	4-31	NS	4-32	NS	4-33
ANB P Lined	Sig inc	4-34	Sig dec	4-35	Sig inc	4-36
ANT P Lined	Sig inc	4-37	Sig dec	4-38	Sig inc	4-39

TABLE 4-3

ANALYSIS OF COVARIANCE COMPARISON OF REGRESSIONS
VERY LOW RATE TENSILE (0.0002 in/min)

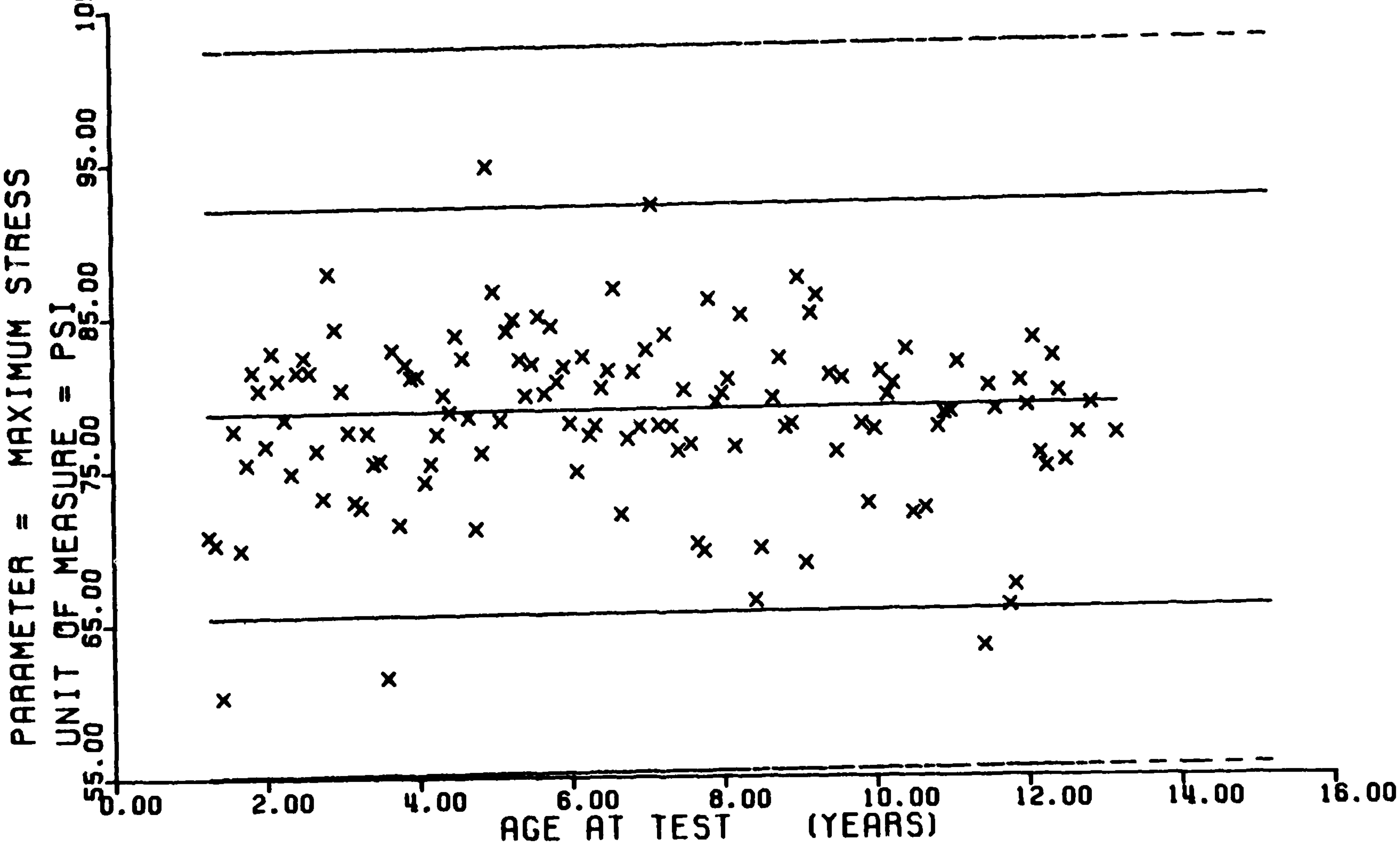
		Sm	Er	E
Lined Vs Unlined				
ANB P-polymer	Residual Variance	S	S	S
	Slope	S	S	S
	Elevation	S	S	S
ANB G-polymer	Residual Variance	S	NS	S
	Slope	S	S	S
	Elevation	S	S	S
ANT P-polymer	Residual Variance	S	S	S
	Slope	S	S	NS
	Elevation	S	S	S
ANB P Unlined Vs ANT P Lined	Residual Variance	NS	S	S
	Slope	NS	S	S
	Elevation	S	S	S
G-polymer Vs P-polymer				
ANB Lined	Residual Variance	NS	NS	NS
	Slope	NS	NS	NS
	Elevation	NS	NS	NS
ANB Unlined	Residual Variance	S	S	S
	Slope	NS	NS	NS
	Elevation	S	NS	S
ANB G Unlined Vs ANT P Unlined	Residual Variance	S	S	S
	Slope	S	NS	S
	Elevation	NS	S	S
ANB G Lined Vs ANT P Lined	Residual Variance	S	NS	NS
	Slope	S	NS	NS
	Elevation	NS	S	S
ANB P-polymer Vs ANT P-polymer				
Lined	Residual Variance	S	S	NS
	Slope	S	S	NS
	Elevation	S	S	S
Unlined	Residual Variance	S	S	S
	Slope	S	NS	S
	Elevation	S	S	NS

NOTE: Sm = Maximum Stress, Er = Strain at Rupture, and E = Modulus. S means a significant difference and NS means not significant.

Y = ((+7.8665961E+01) + (+4.0374665E-03) × X)

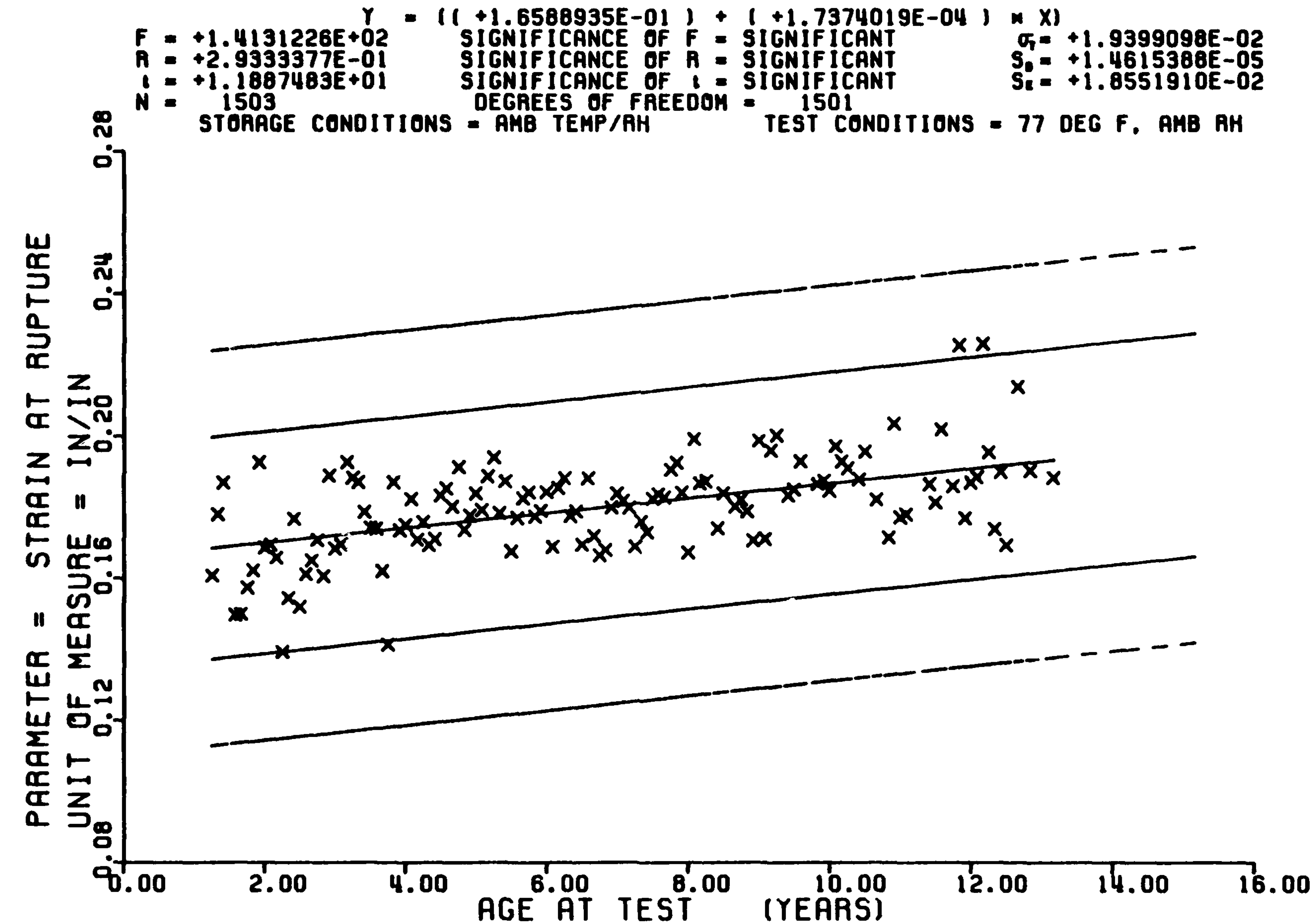
F = +4.2258136E-01   SIGNIFICANCE OF F = NOT SIGNIFICANT σ_T = +7.8822197E+00
R = +1.6776590E-02   SIGNIFICANCE OF R = NOT SIGNIFICANT S_B = +6.2108889E-03
ι = +6.5006258E-01   SIGNIFICANCE OF ι = NOT SIGNIFICANT S_E = +7.8837352E+00
N = 1503   DEGREES OF FREEDOM = 1501

STORAGE CONDITIONS = AMB TEMP/RH   TEST CONDITIONS = 77 DEG F, AMB RH



TENSILE MAXIMUM STRESS, ANB-3066 (ANB G-POLYMER UNLINED), 0.0002 IN/MIN

Figure 4-1



TENSILE STRAIN AT RUPTURE, ANB-3066 (ANB G-POLYMER UNLINED), 0.0002 IN/MIN

Figure 4-2

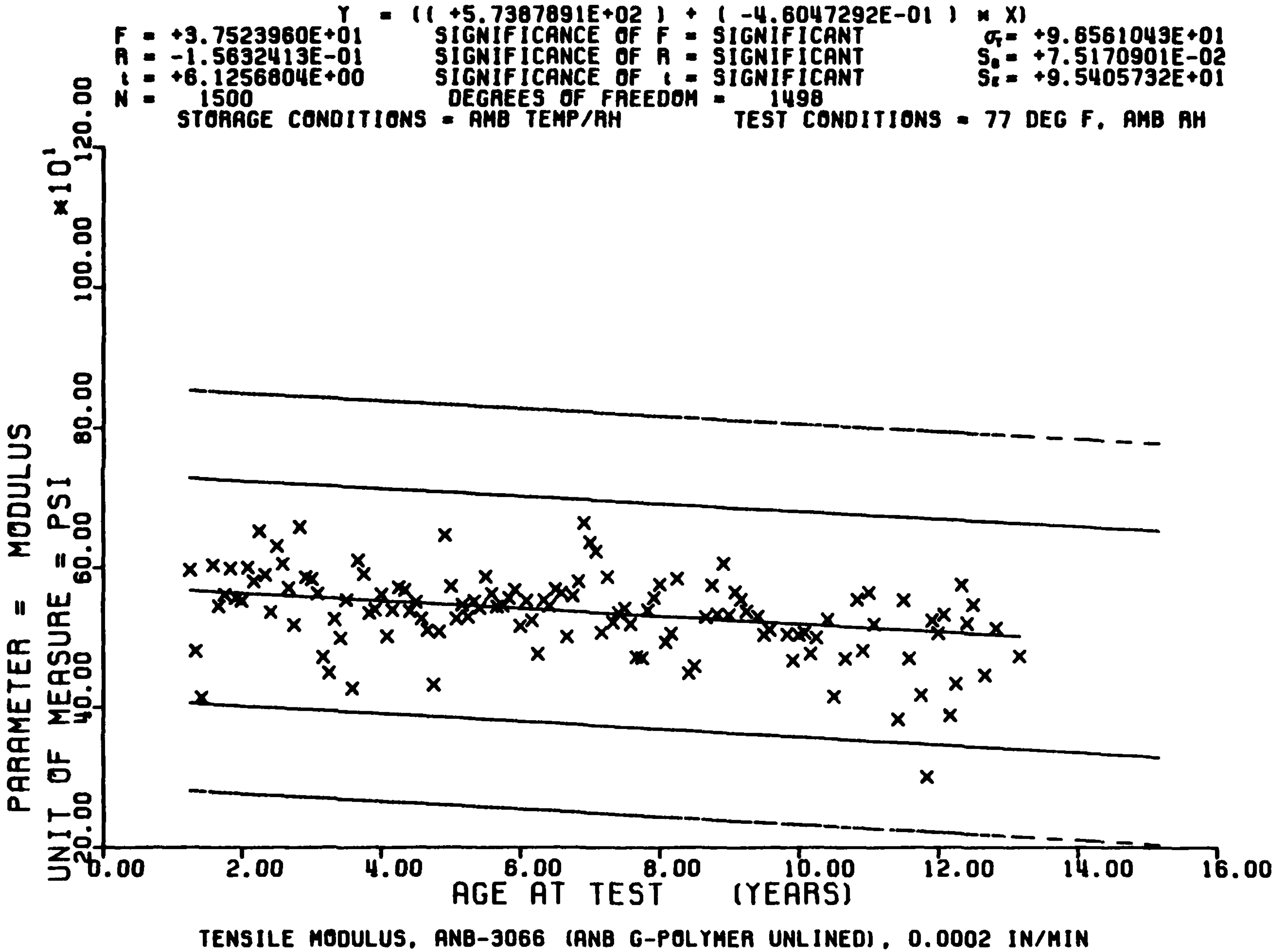
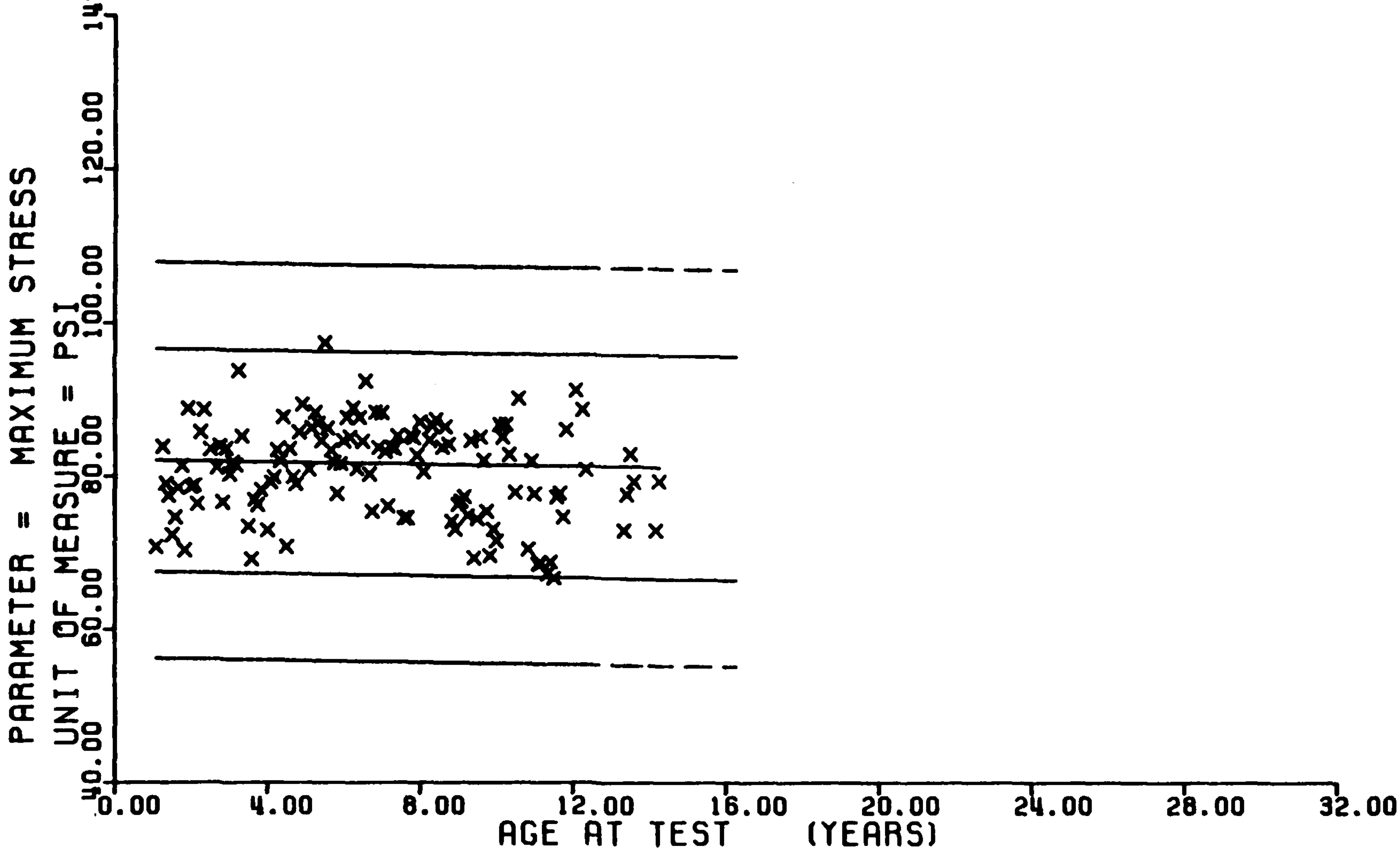

Y = ((+5.7387891E+02) + (-4.6047292E-01) * X)
F = +3.7523960E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +9.6561043E+01
R = -1.5632413E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +7.5170901E-02
t = +6.1256804E+00 SIGNIFICANCE OF t = SIGNIFICANT S_E = +9.5405732E+01
N = 1500 DEGREES OF FREEDOM = 1498
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH
PARAMETER = MODULUS
UNIT OF MEASURE = PSI
*10¹
120.00
100.00
80.00
60.00
40.00
20.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
AGE AT TEST (YEARS)
TENSILE MODULUS, ANB-3066 (ANB G-POLYMER UNLINED), 0.0002 IN/MIN

Figure 4-3

Y = ((+8.2122064E+01) + (-6.4279768E-03) × X)

F = +1.0493427E+00 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_T = +8.6113006E+00
R = -2.7594739E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT S_b = +6.2750273E-03
t = +1.0243743E+00 SIGNIFICANCE OF t = NOT SIGNIFICANT S_e = +8.6111465E+00
N = 1379 DEGREES OF FREEDOM = 1377
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



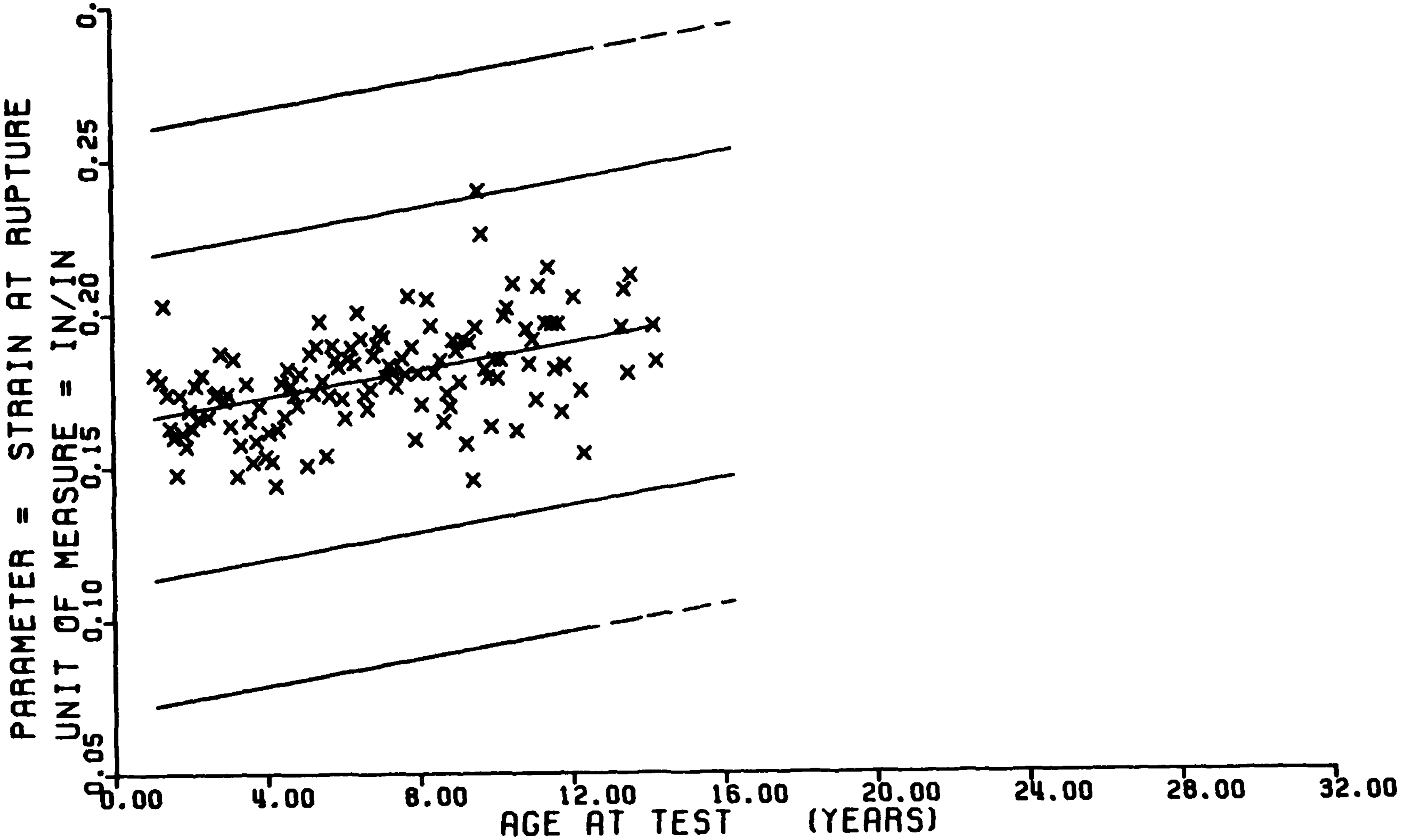
TENSILE MAXIMUM STRESS, ANB-3066 (ANB P-POLYMER UNLINED), 0.0002 IN/MIN

Figure 4-4

Y = ((+1.6405921E-01) + (+1.8358266E-04) * X)

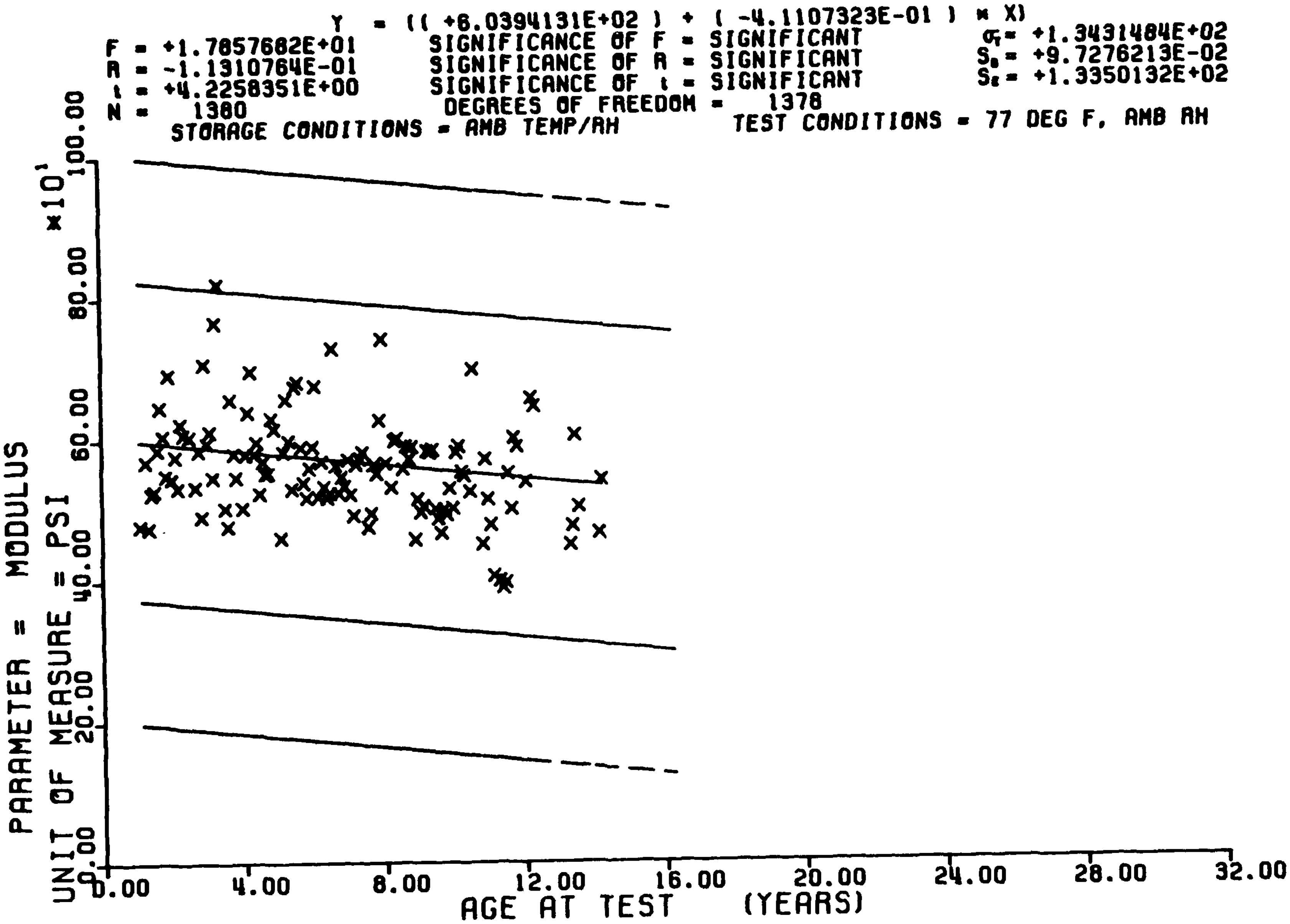
F = +6.4405174E+01   SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +3.2110880E-02
R = +2.1123518E-01   SIGNIFICANCE OF R = SIGNIFICANT S_θ = +2.2875536E-05
t = +8.0252834E+00   SIGNIFICANCE OF t = SIGNIFICANT S_ε = +3.1397685E-02
N = 1381   DEGREES OF FREEDOM = 1379

STORAGE CONDITIONS = AMB TEMP/RH   TEST CONDITIONS = 77 DEG F, AMB RH



TENSILE STRAIN AT RUPTURE, ANB-3066 (ANB P-POLYMER UNLINED), 0.0002 IN/MIN

Figure 4-5



TENSILE MODULUS, ANB-3066 (ANB P-POLYMER UNLINED), 0.0002 IN/MIN

Figure 4-6

Y = ((+7.2989302E+01) + (+1.0028338E-01) × X)

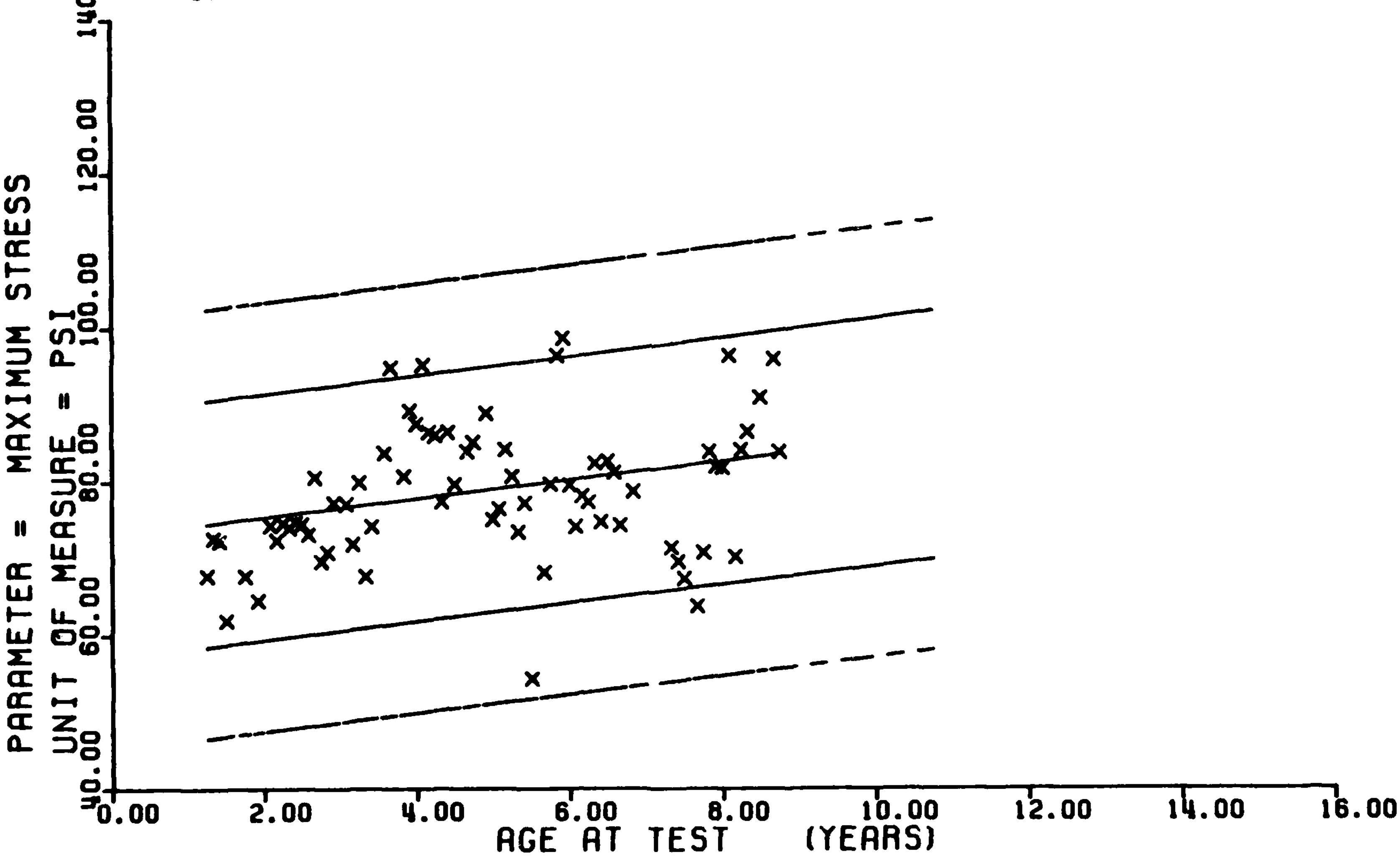
F = +3.5120592E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_T = +9.6352718E+00

R = +2.6010385E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +1.6921859E-02

ι = +5.9262629E+00 SIGNIFICANCE OF ι = SIGNIFICANT S_E = +9.3132382E+00

N = 486 DEGREES OF FREEDOM = 484

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



TENSILE MAXIMUM STRESS, ANB-3066 (ANT P-POLYMER UNLINED), 0.0002 IN/MIN

Figure 4-7

Y = ((+1.6133738E-01) + (+9.8698714E-05) * X)

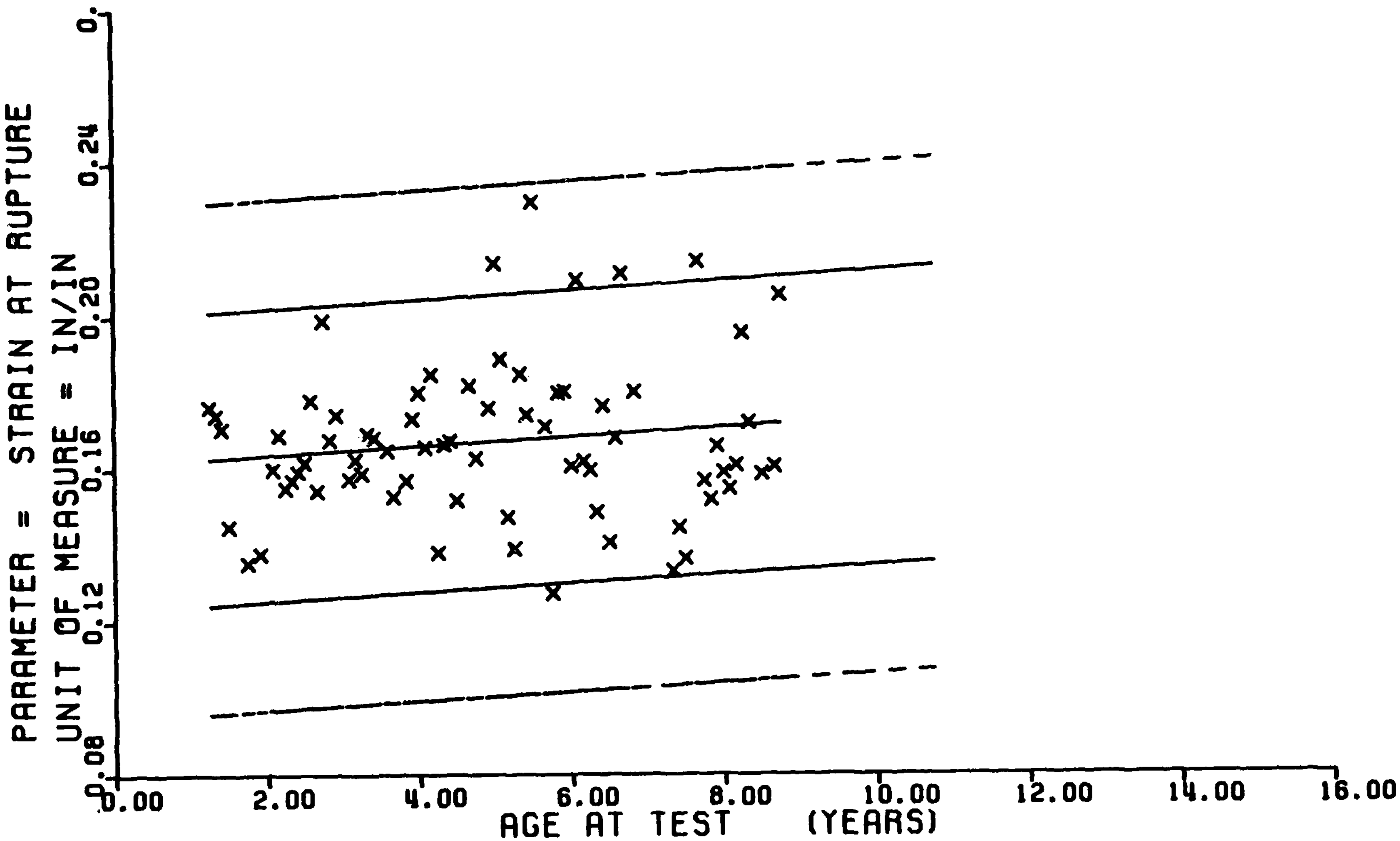
F = +5.9413331E+00 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +2.2398727E-02

R = +1.1012094E-01 SIGNIFICANCE OF R = SIGNIFICANT S_a = +4.0492029E-05

t = +2.4374849E+00 SIGNIFICANCE OF t = SIGNIFICANT S_t = +2.2285489E-02

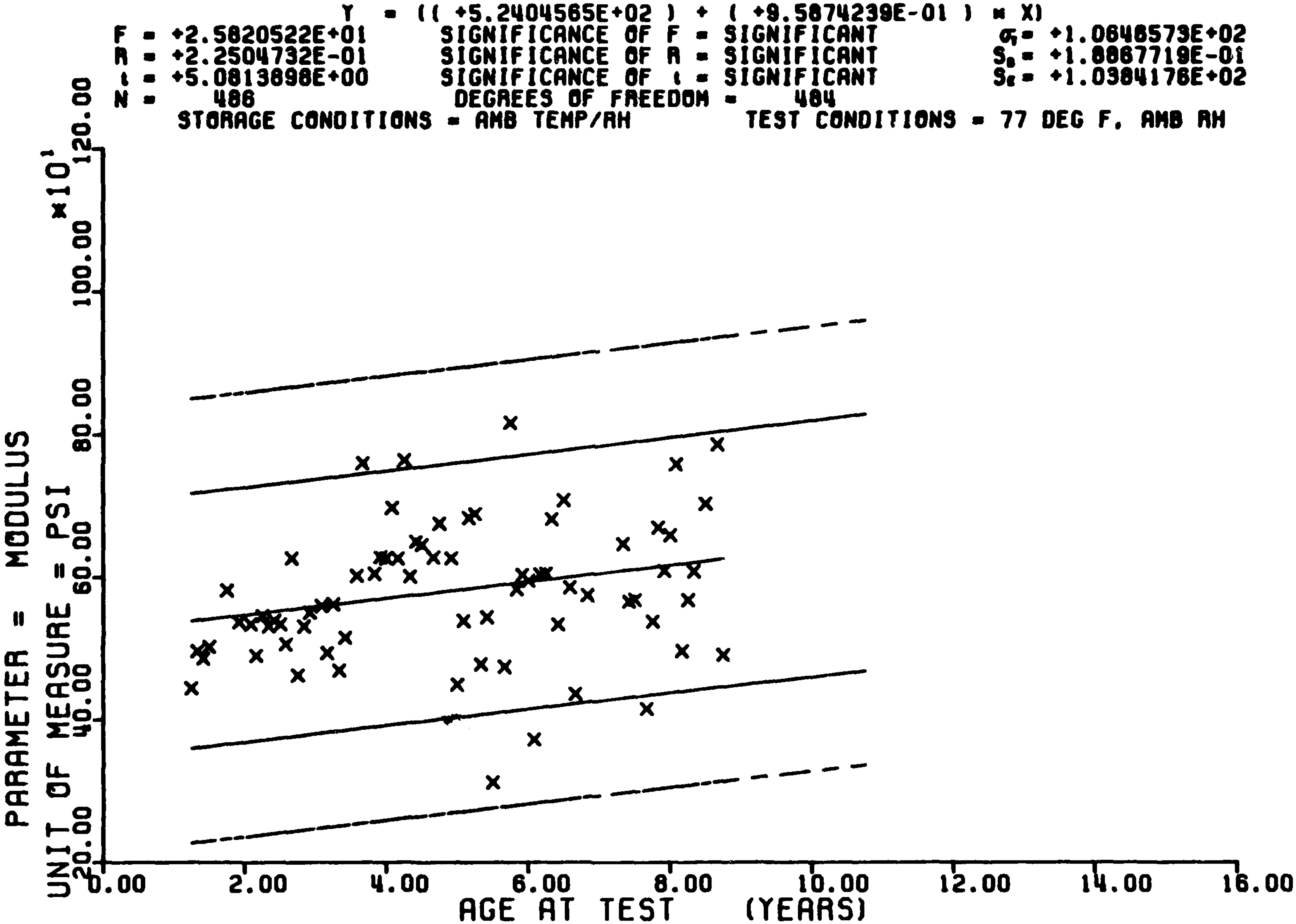
N = 486 DEGREES OF FREEDOM = 484

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



TENSILE STRAIN AT RUPTURE, ANB-3066 (ANT P-POLYMER UNLINED), 0.0002 IN/MIN

Figure 4-8

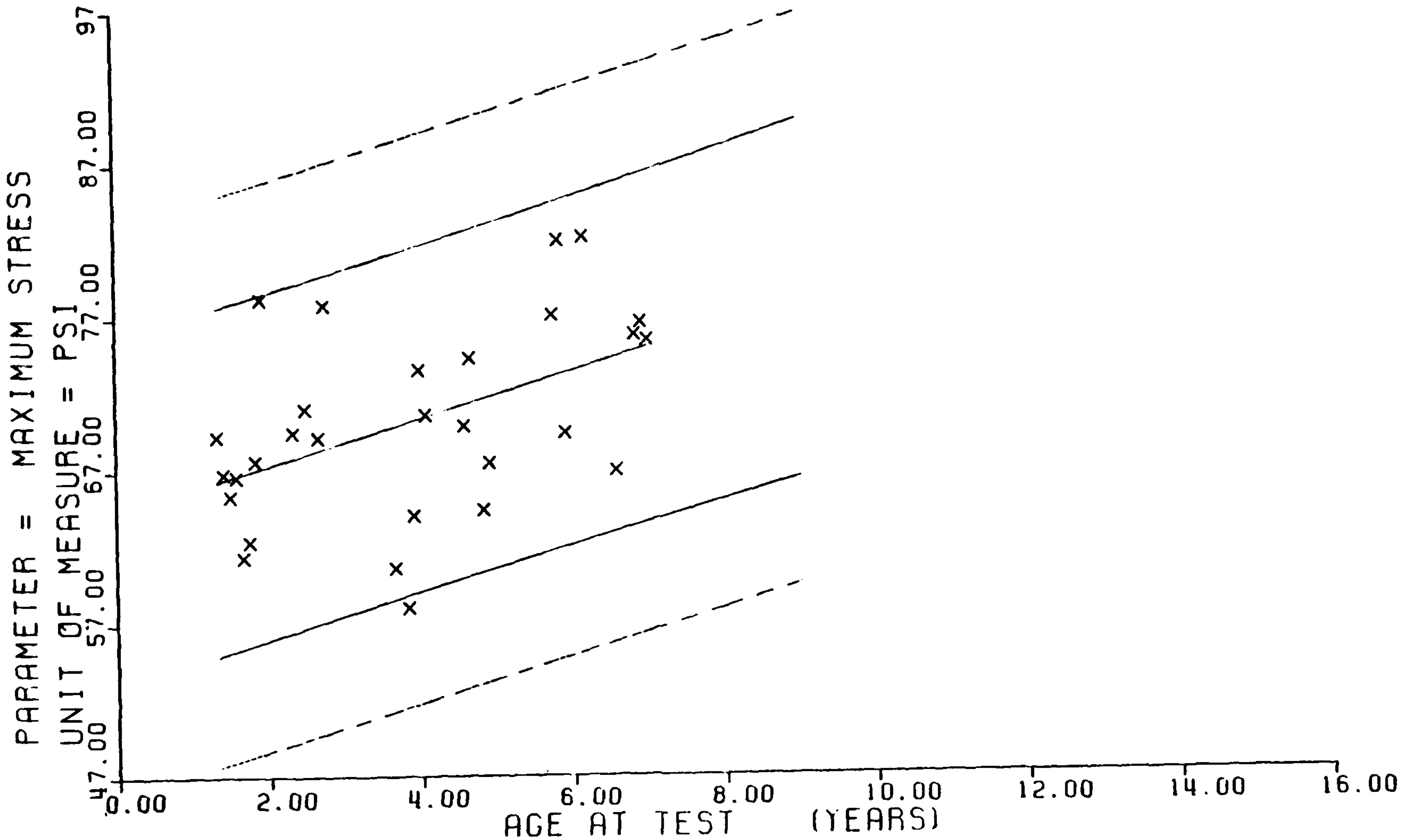


TENSILE MODULUS, ANB-3066 (ANT P-POLYMER UNLINED), 0.0002 IN/MIN

Figure 4-9

Y = ((+6.4240572E+01) + (+1.2830590E-01) * X)

F = +2.5636097E+01   SIGNIFICANCE OF F = SIGNIFICANT σ_T = +6.8851898E+00
R = +4.4130460E-01   SIGNIFICANCE OF R = SIGNIFICANT S_b = +2.5340821E-02
ι = +5.0632101E+00   SIGNIFICANCE OF ι = SIGNIFICANT S_ε = +6.2075512E+00
N = 108   DEGREES OF FREEDOM = 106
STORAGE CONDITIONS = AMB TEMP/RH   TEST CONDITIONS = 77 DEG F, AMB RH



TENSILE MAXIMUM STRESS, ANB-3066 (ANB G-POLYMER LINED), 0.0002 IN/MIN

Figure 4-10

Y = ((+1.7176931E-01) + (-2.4038245E-04) * X)

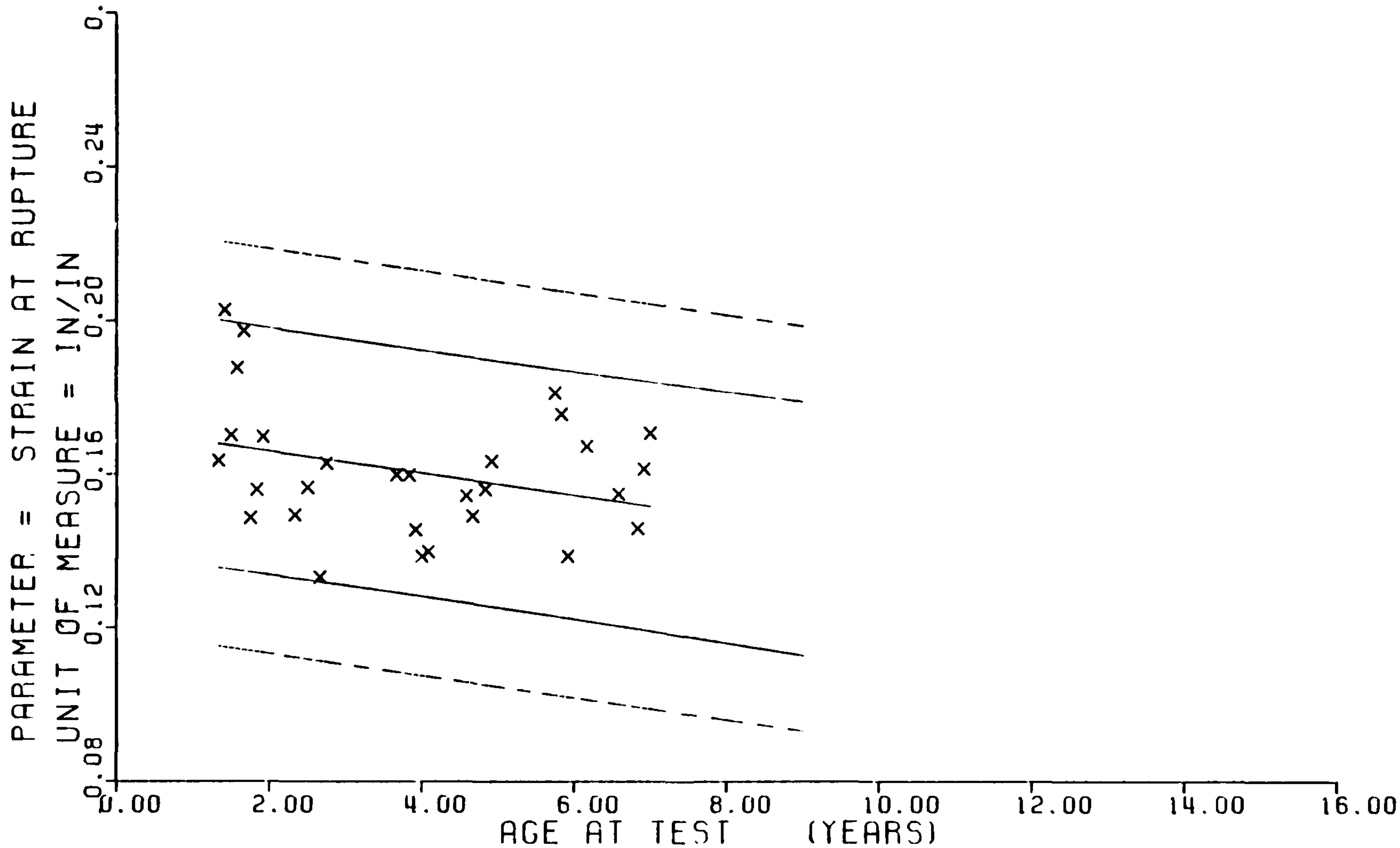
F = +1.1234265E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_1 = +1.8389309E-02

R = -3.0956015E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +7.1718371E-05

ι = +3.3517555E+00 SIGNIFICANCE OF ι = SIGNIFICANT S_E = +1.7568311E-02

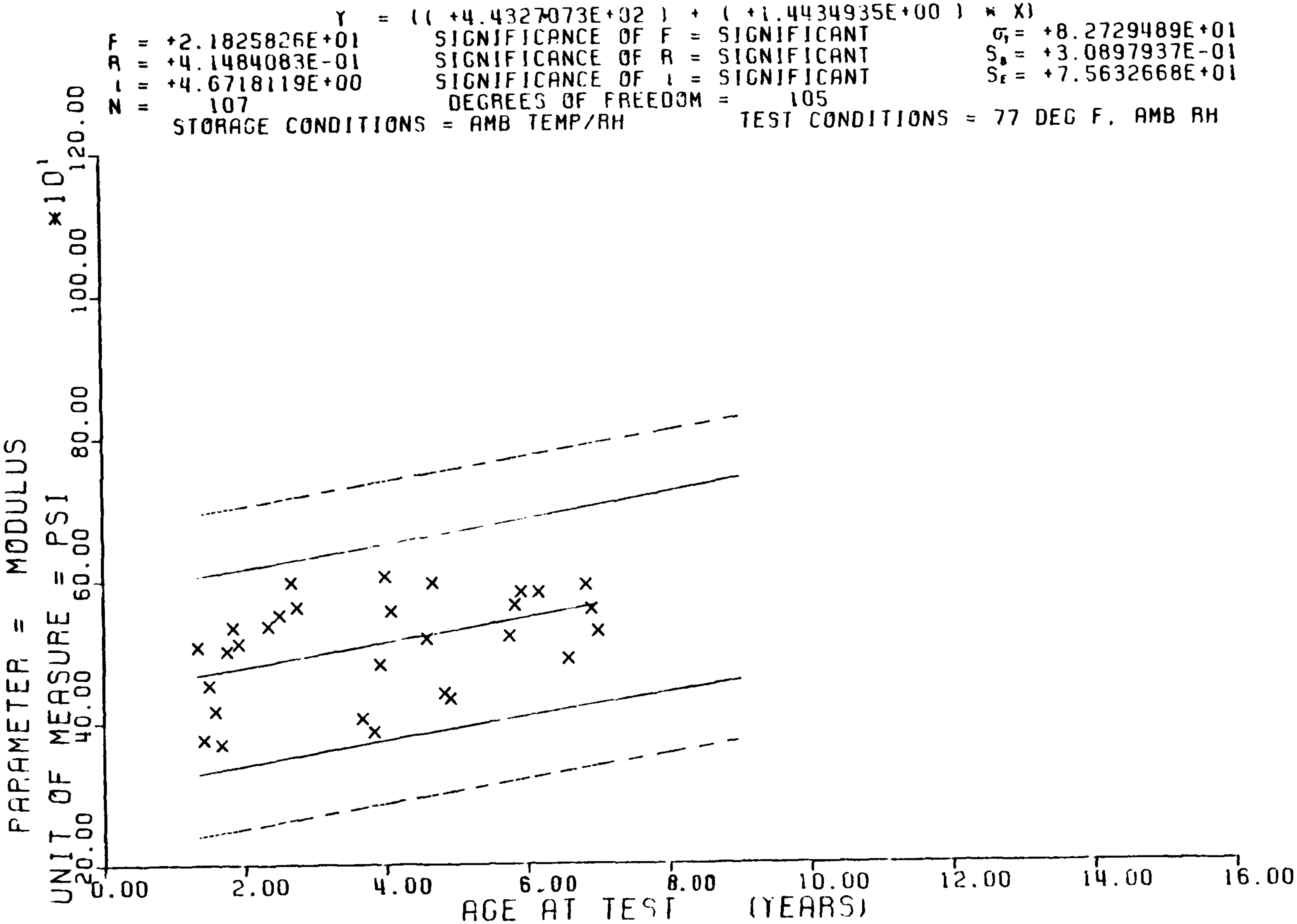
N = 108 DEGREES OF FREEDOM = 106

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



TENSILE STRAIN AT RUPTURE, ANB-3066 (ANB G-POLYMER LINED), 0.0002 IN/MIN

Figure 4-11



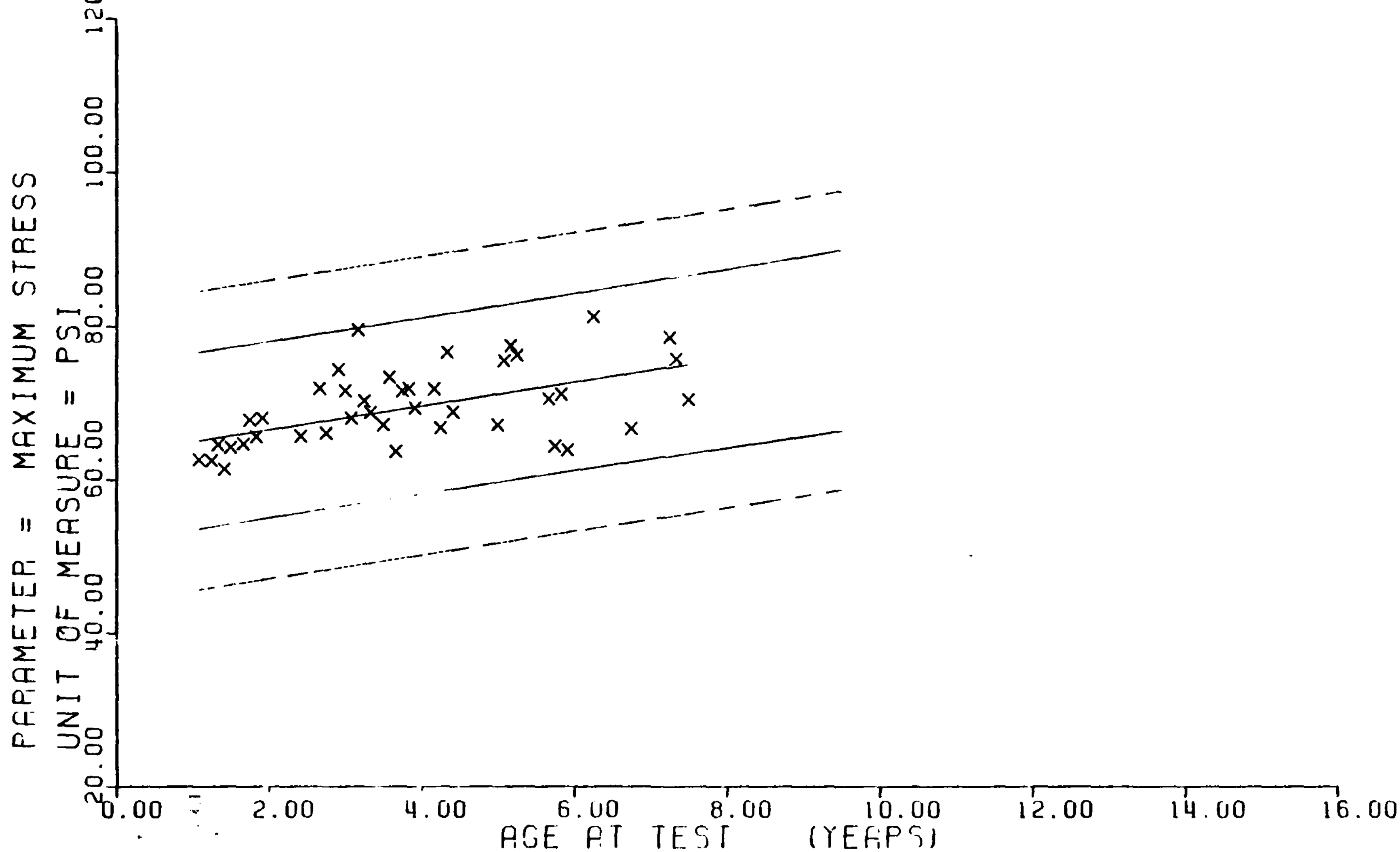
TENSILE MODULUS, ANB-3066 (ANB G-POLYMER LINED), 0.0002 IN/MIN

Figure 4-12

Y = ((+6.3453027E+01) + (+1.2812800E-01) * X)

F = +3.9166580E+01   SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +7.1019480E+00
R = +4.1251210E-01   SIGNIFICANCE OF R = SIGNIFICANT S_B = +2.0473224E-02
t = +6.2583208E+00   SIGNIFICANCE OF t = SIGNIFICANT S_E = +6.4864485E+00
N = 193   DEGREES OF FREEDOM = 191

STORAGE CONDITIONS = AMB TEMP/RH   TEST CONDITIONS = 77 DEG F. AMB RH



TENSILE MAXIMUM STRESS, ANB-3066 (ANB P-POLYMER LINED), 0.0002 IN/MIN

Figure 4-13

Y = ((+1.7201410E-01) + (-1.7844402E-04) × X)

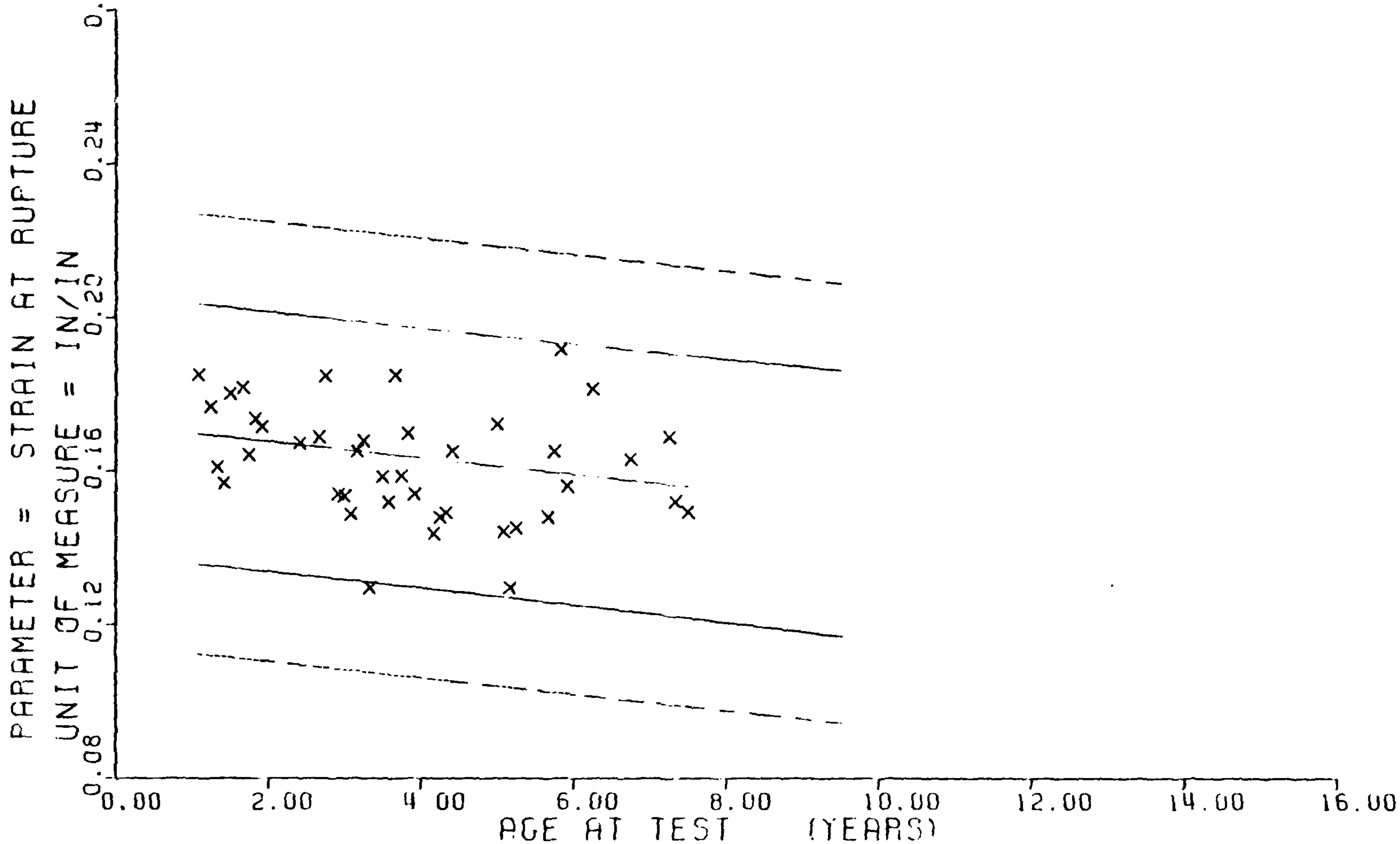
F = +8.7685111E+00 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +1.9474786E-02

R = -2.0950742E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +6.0261381E-05

t = +2.9611671E+00 SIGNIFICANCE OF t = SIGNIFICANT S_t = +1.9092368E-02

N = 193 DEGREES OF FREEDOM = 191

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



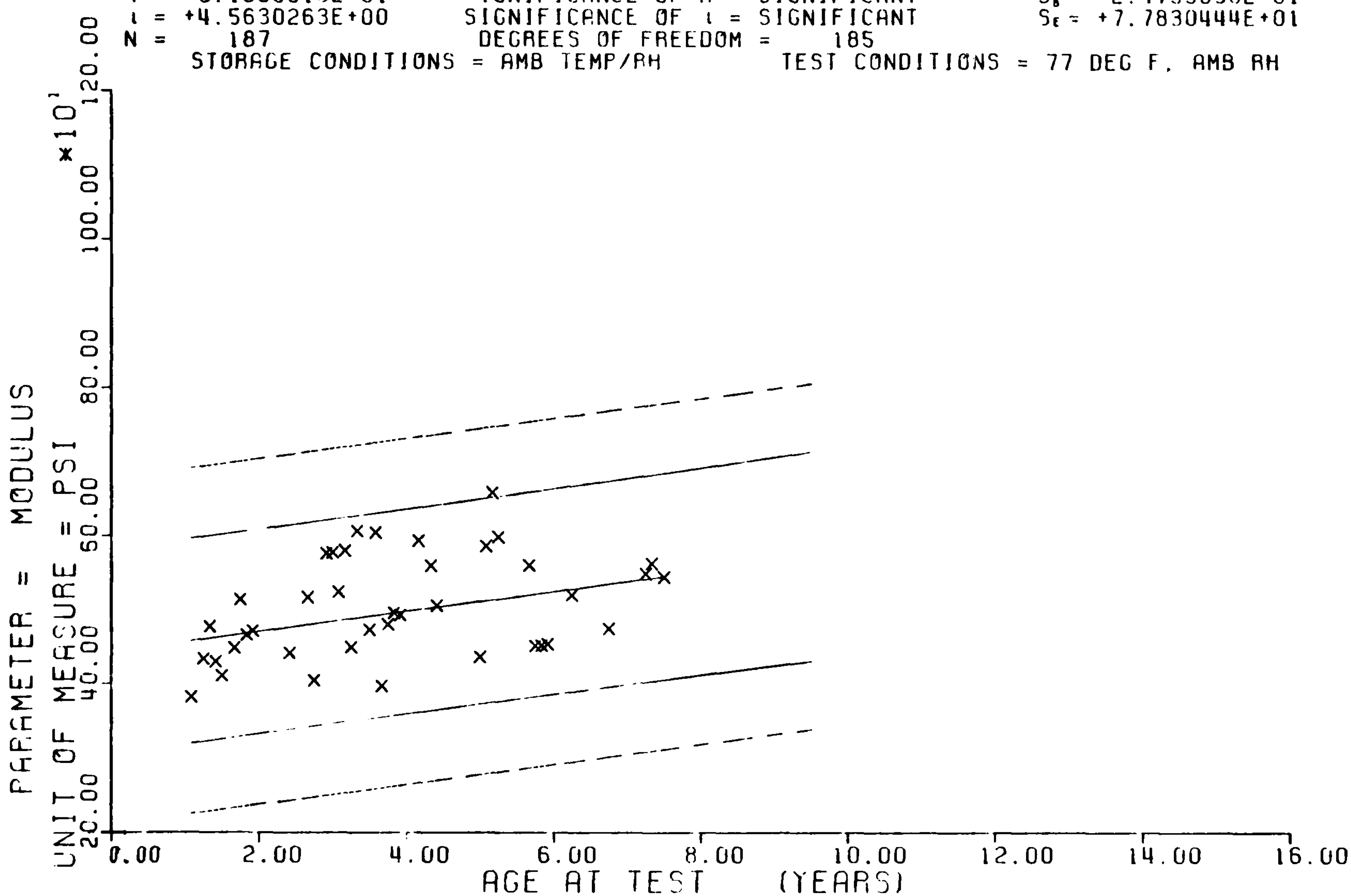
TENSILE STRAIN AT RUPTURE, ANB-3066 (ANB P-POLYMER LINED), 0.0002 IN/MIN

Figure 4-14

Y = ((+4.4368213E+02) + (+1.1296150E+00) * X)

F = +2.0821209E+01	SIGNIFICANCE OF F = SIGNIFICANT	σ_Y = +8.1872509E+01
R = +3.1805916E-01	SIGNIFICANCE OF R = SIGNIFICANT	S_B = +2.4755830E-01
t = +4.5630263E+00	SIGNIFICANCE OF t = SIGNIFICANT	S_E = +7.7830444E+01
N = 187	DEGREES OF FREEDOM = 185	

STORAGE CONDITIONS = AMB TEMP/RH   TEST CONDITIONS = 77 DEG F, AMB RH

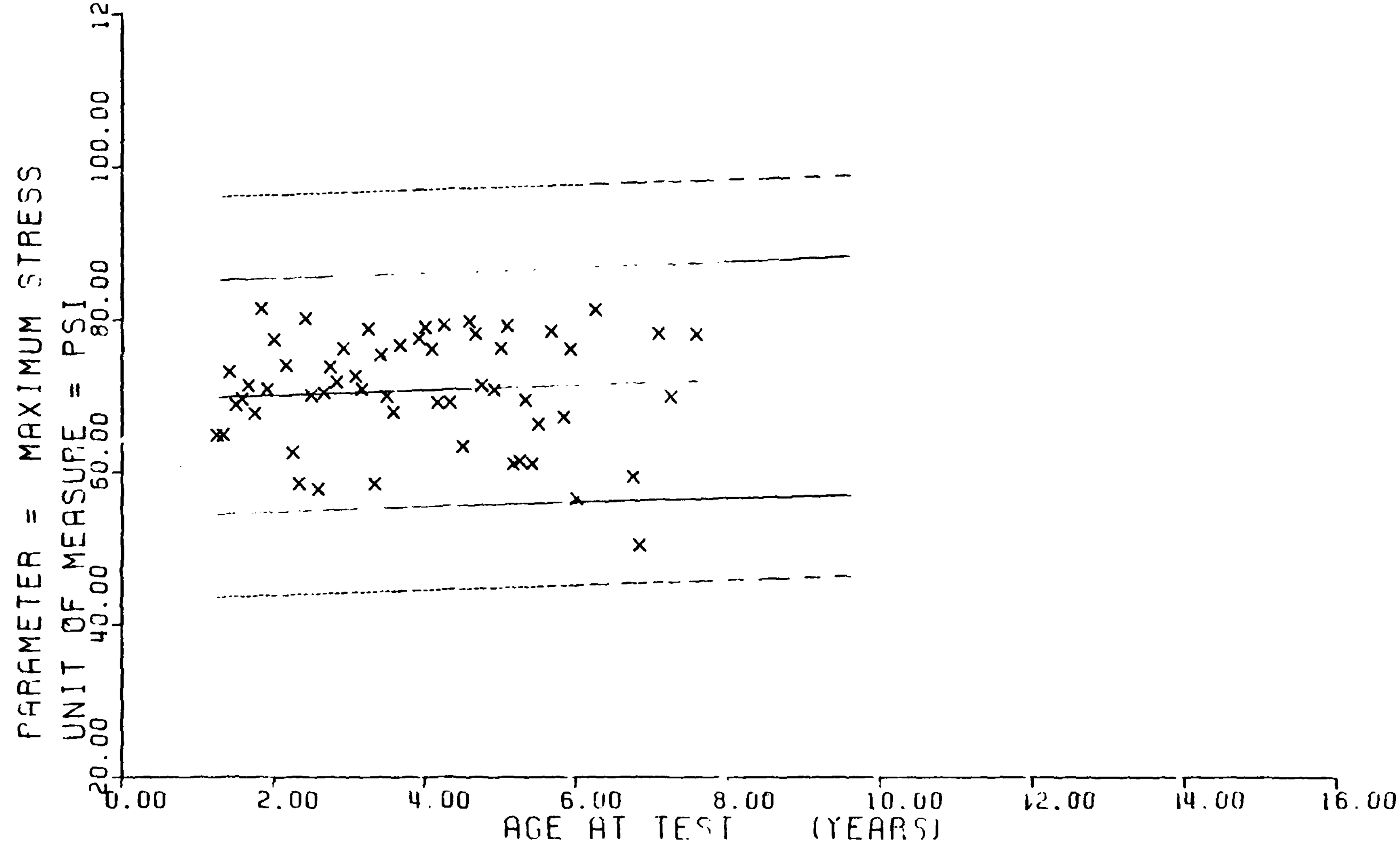


TENSILE MODULUS, ANB-3066 (ANB P-POLYMER LINED), 0.0002 IN/MIN

Figure 4-15

Y = ((+6.9351580E+01) + (+2.8676313E-02) * X)

F = +1.1310647E+00 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_Y = +8.7513025E+00
R = +6.5562828E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT S_B = +2.6963705E-02
t = +1.0635153E+00 SIGNIFICANCE OF t = NOT SIGNIFICANT S_E = +8.7491227E+00
N = 264 DEGREES OF FREEDOM = 262
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



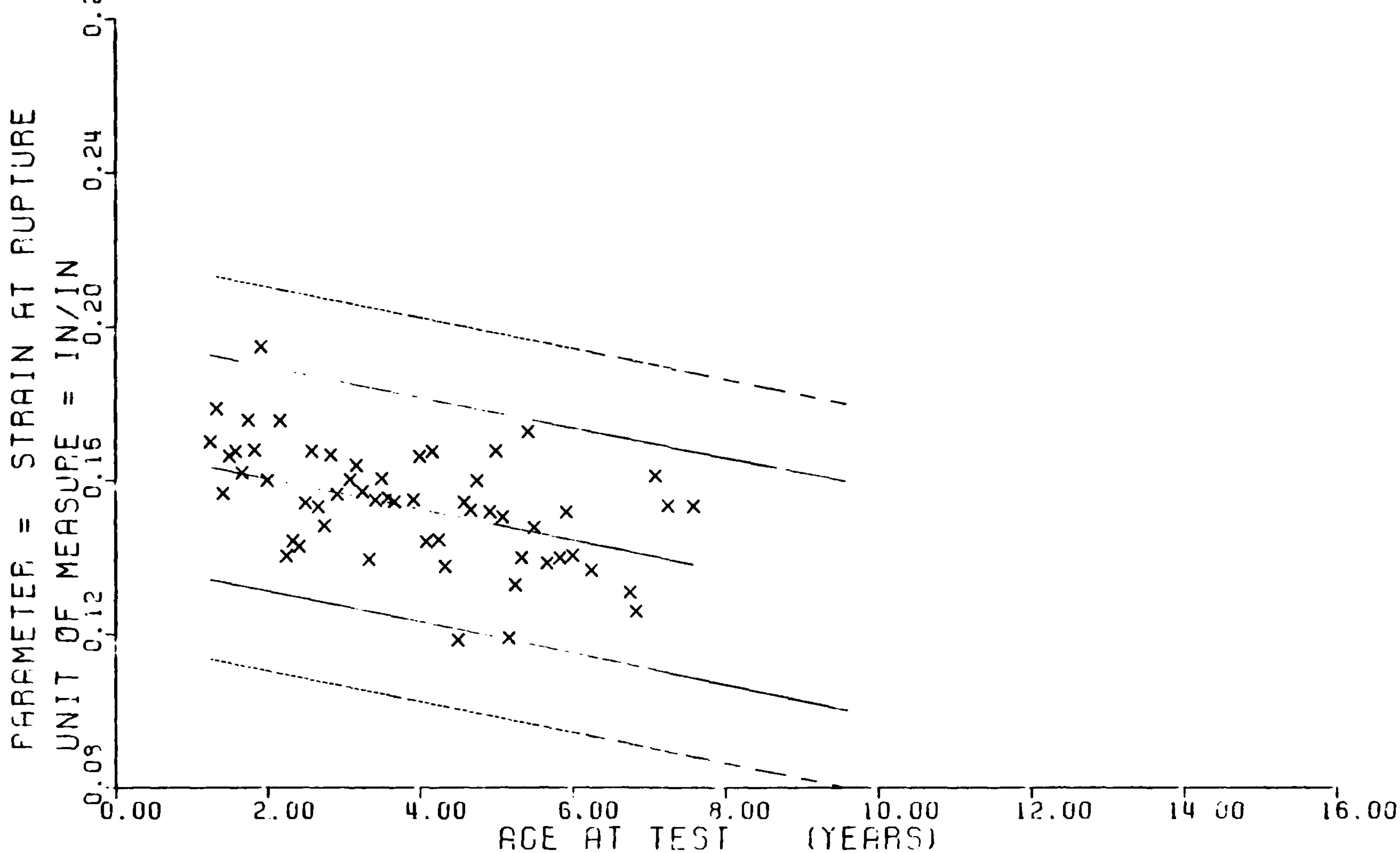
TENSILE MAXIMUM STRESS, ANB-3066 (ANT P POLYMER LINED), 0.0002 IN/MIN

Figure 4-16

Y = ((+1.6851861E-01) + (-3.3564461E-04) * X)

F = +4.2816339E+01	SIGNIFICANCE OF F = SIGNIFICANT	σ_Y = +1.7918477E-02
R = -3.7478797E-01	SIGNIFICANCE OF R = SIGNIFICANT	S_B = +5.1294986E-05
ι = +6.5434195E+00	SIGNIFICANCE OF ι = SIGNIFICANT	S_E = +1.6644082E-02
N = 264	DEGREES OF FREEDOM = 262	

STORAGE CONDITIONS = AMB TEMP/RH   TEST CONDITIONS = 77 DEG F, AMB RH



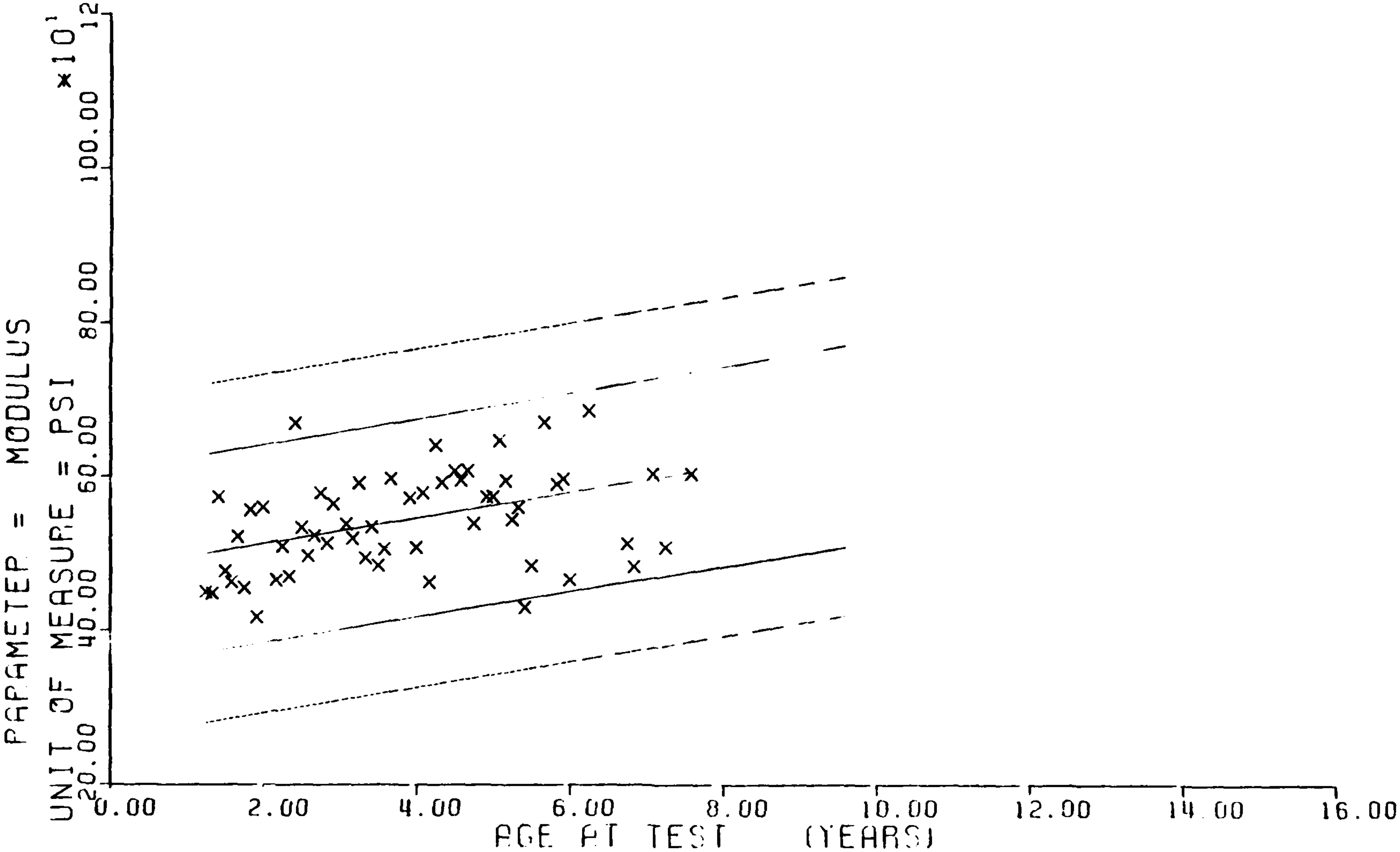
TENSILE STRAIN AT RUPTURE, ANB-3066 (ANT P-POLYMER LINED), 0.0002 IN/MIN

Figure 4-17

Y = ((+4.7928984E+02) + (+1.3936056E+00) * X)

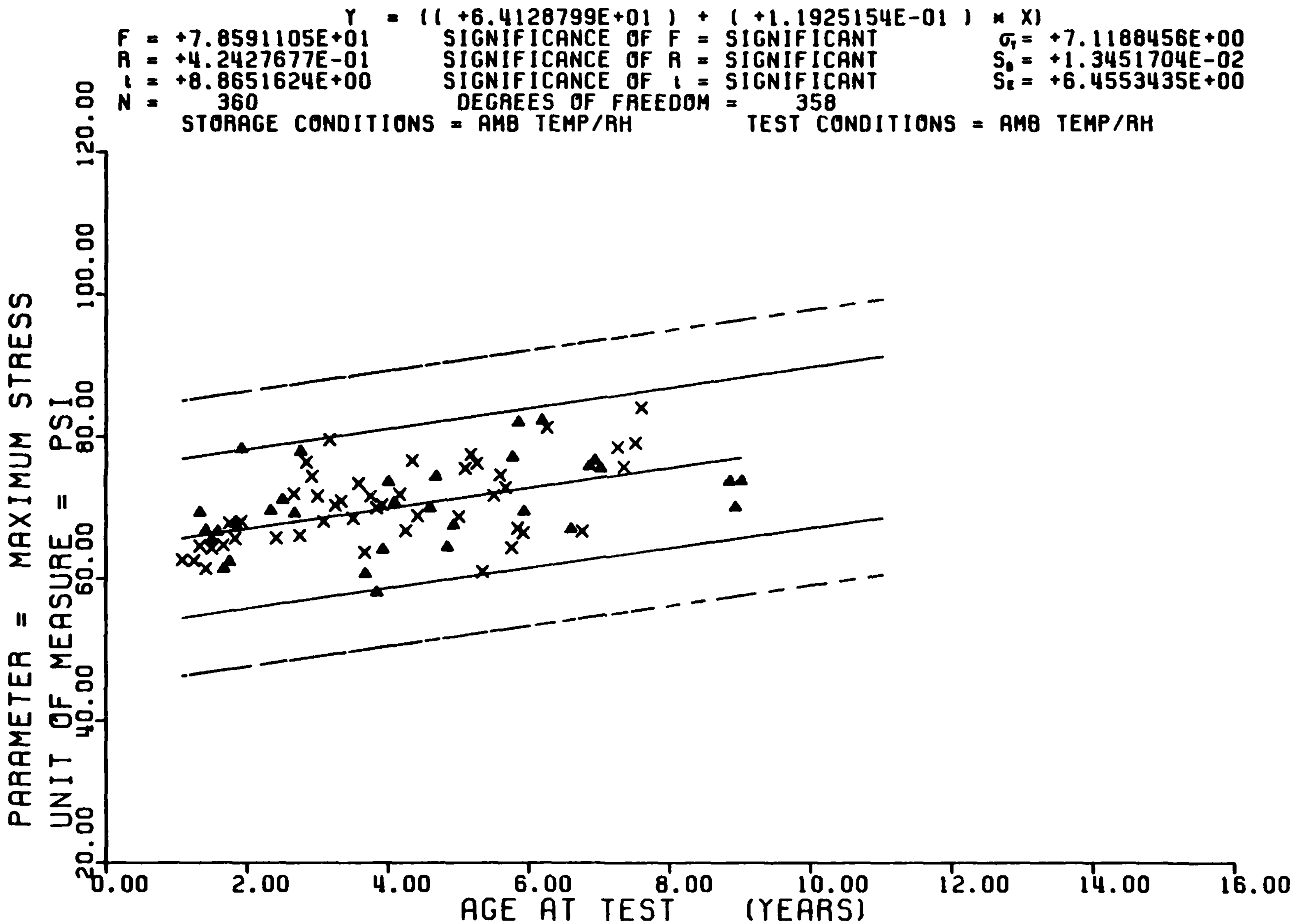
F = +3.7987600E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +7.8356978E+01
R = +3.5585188E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +2.2610958E-01
ι = +6.1634081E+00 SIGNIFICANCE OF ι = SIGNIFICANT S_ε = +7.3367530E+01
N = 264 DEGREES OF FREEDOM = 262

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



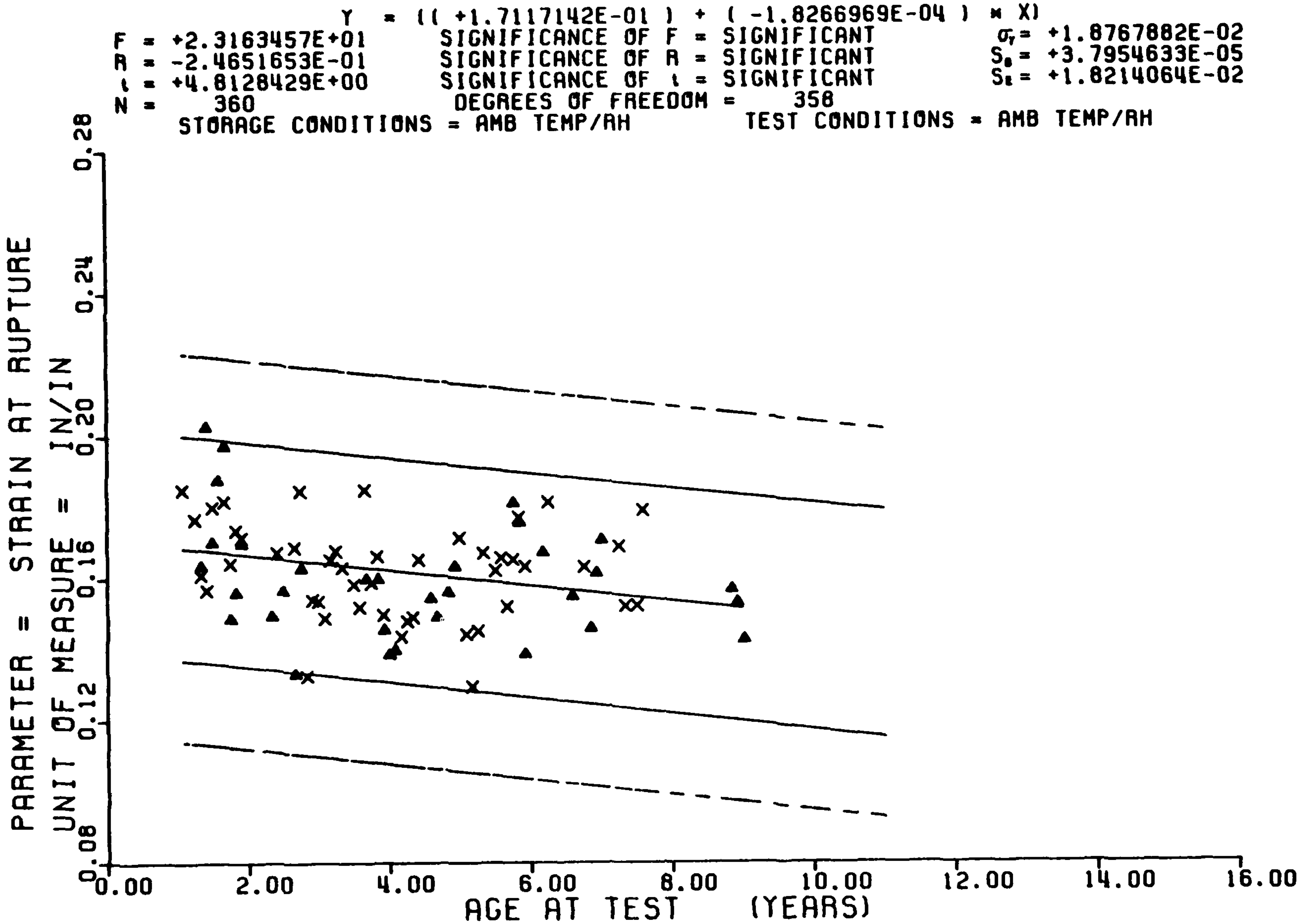
TENSILE MODULUS, ANB-3066 (ANT P-POLYMER LINED), 0.0002 IN/MIN

Figure 4-18



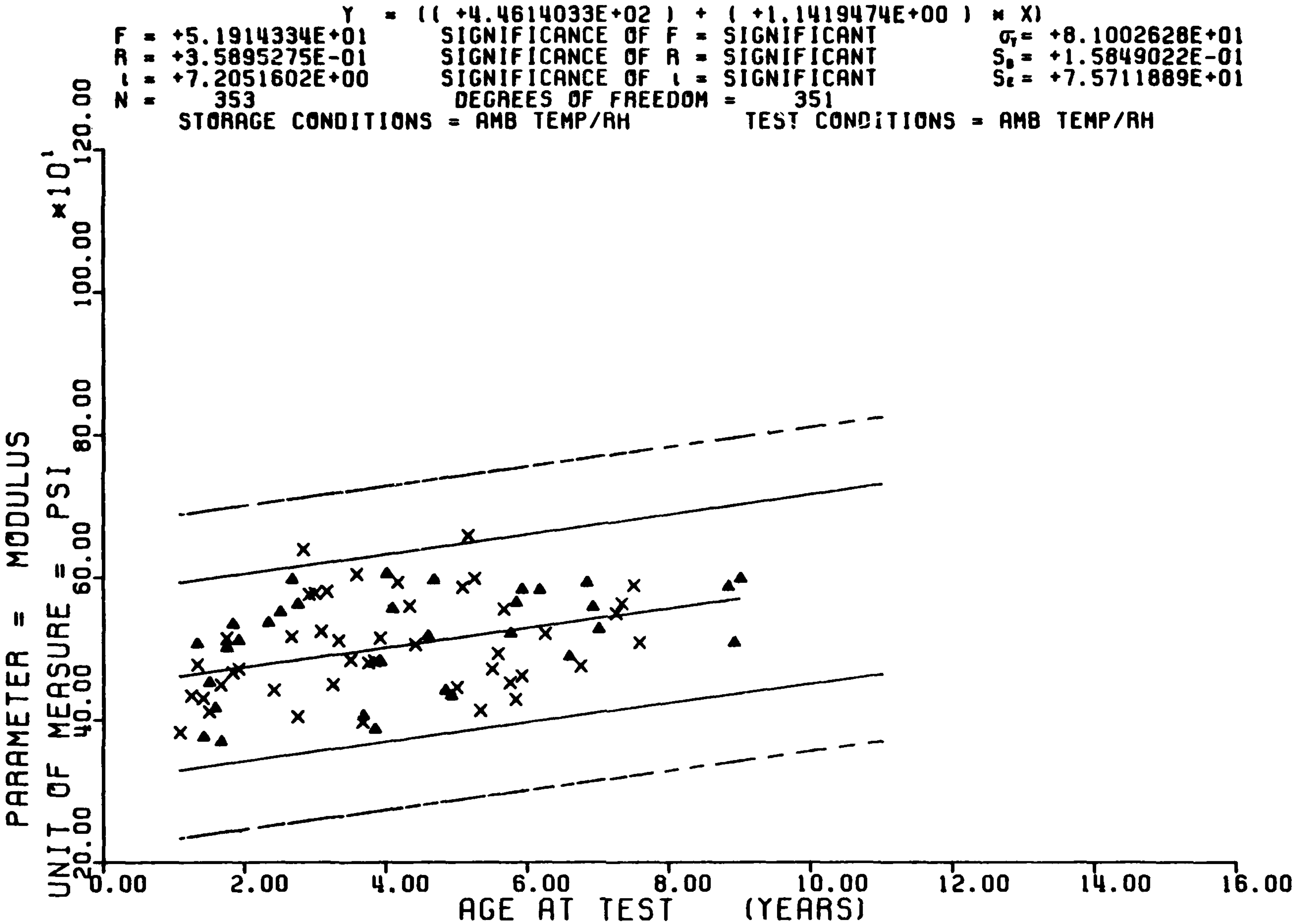
TENSILE MAXIMUM STRESS, ANB-3066 (ANB G & P POLYMERS LINED), 0.0002 IN/MIN

Figure 4-19



TENSILE RUPTURE STRAIN, ANB-3066 (ANB G & P POLYMERS LINED), 0.0002 IN/MIN

Figure 4-20



TENSILE MODULUS, ANB-3066 (ANB G & P POLYMERS LINED), 0.0002 IN/MIN

Figure 4-21

TABLE 4-4

ANALYSIS OF COVARIANCE COMPARISON OF REGRESSIONS
LOW RATE UNIAXIAL TENSILE (2 in/min)

		Sm	Er	E
Lined Vs Unlined				
ANB P-polymer	Residual Variance	S	S	S
	Slope	S	S	NS
	Elevation	S	S	S
ANB G-polymer	Residual Variance	S	S	S
	Slope	NS	NS	NS
	Elevation	S	S	S
ANT P-polymer	Residual Variance	S	S	S
	Slope	S	S	S
	Elevation	S	S	S
ANB P Unlined Vs ANT P Lined	Residual Variance	S	S	S
	Slope	S	S	S
	Elevation	S	NS	S
G-polymer Vs P-polymer				
ANB Lined	Residual Variance	S	S	S
	Slope	NS	NS	NS
	Elevation	S	S	S
ANB Unlined	Residual Variance	S	S	S
	Slope	NS	S	S
	Elevation	S	S	S
ANB G Unlined Vs ANT P Unlined	Residual Variance	S	S	S
	Slope	S	S	S
	Elevation	S	S	S
ANB G Lined Vs ANT P Lined	Residual Variance	NS	S	NS
	Slope	S	S	S
	Elevation	S	NS	S
ANB P-polymer Vs ANT P-polymer				
Lined	Residual Variance	S	S	S
	Slope	S	S	S
	Elevation	S	S	S
Unlined	Residual Variance	S	S	S
	Slope	S	S	S
	Elevation	S	NS	S

Y = ((+1.3623734E+02) + (-1.8452478E-02) * X)

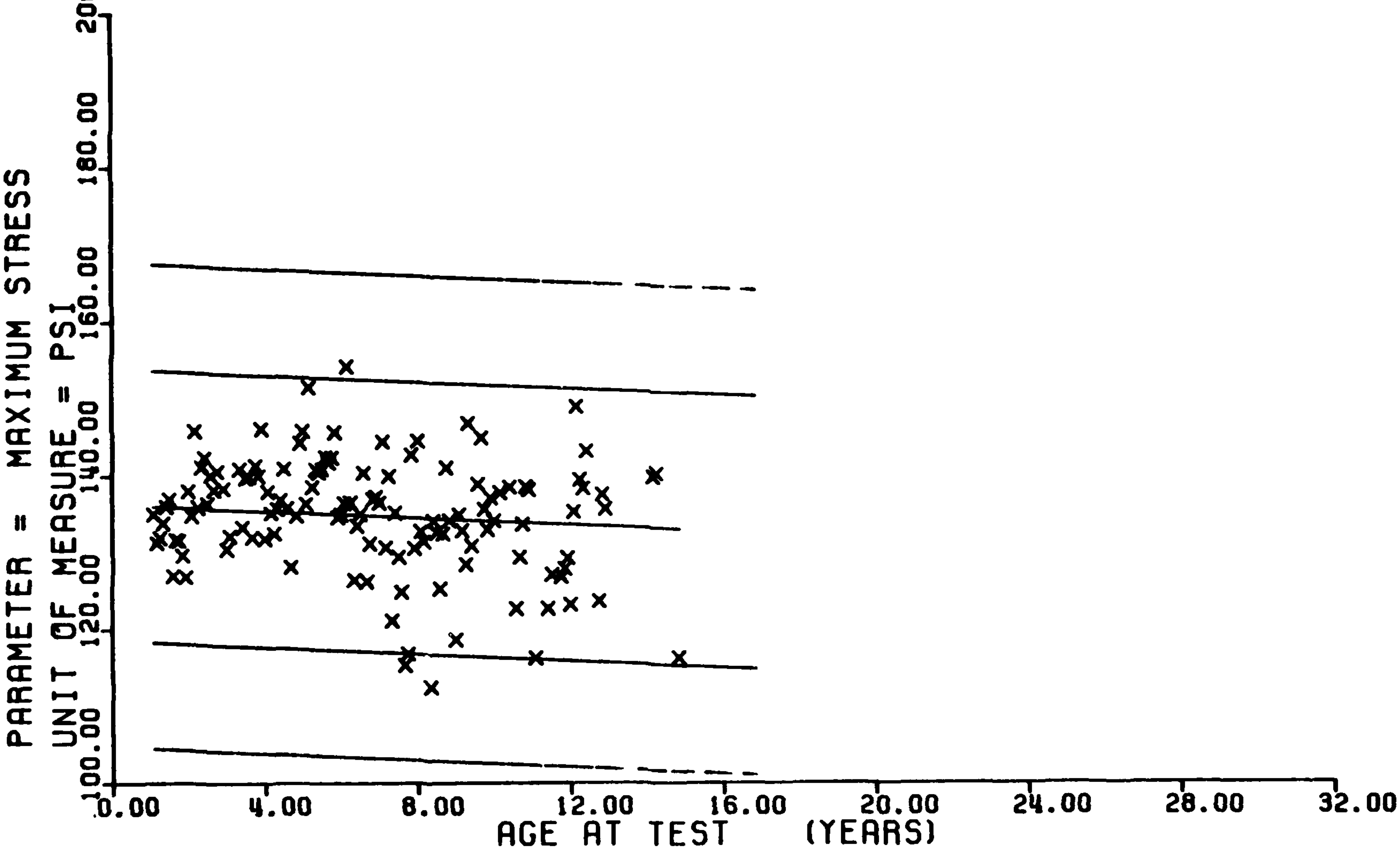
F = +8.2253941E+00 SIGNIFICANCE OF F = SIGNIFICANT σ_T = +1.0519090E+01

R = -7.0281633E-02 SIGNIFICANCE OF R = SIGNIFICANT S_b = +6.4339303E-03

ι = +2.8679947E+00 SIGNIFICANCE OF ι = SIGNIFICANT S_E = +1.0496244E+01

N = 1659 DEGREES OF FREEDOM = 1657

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



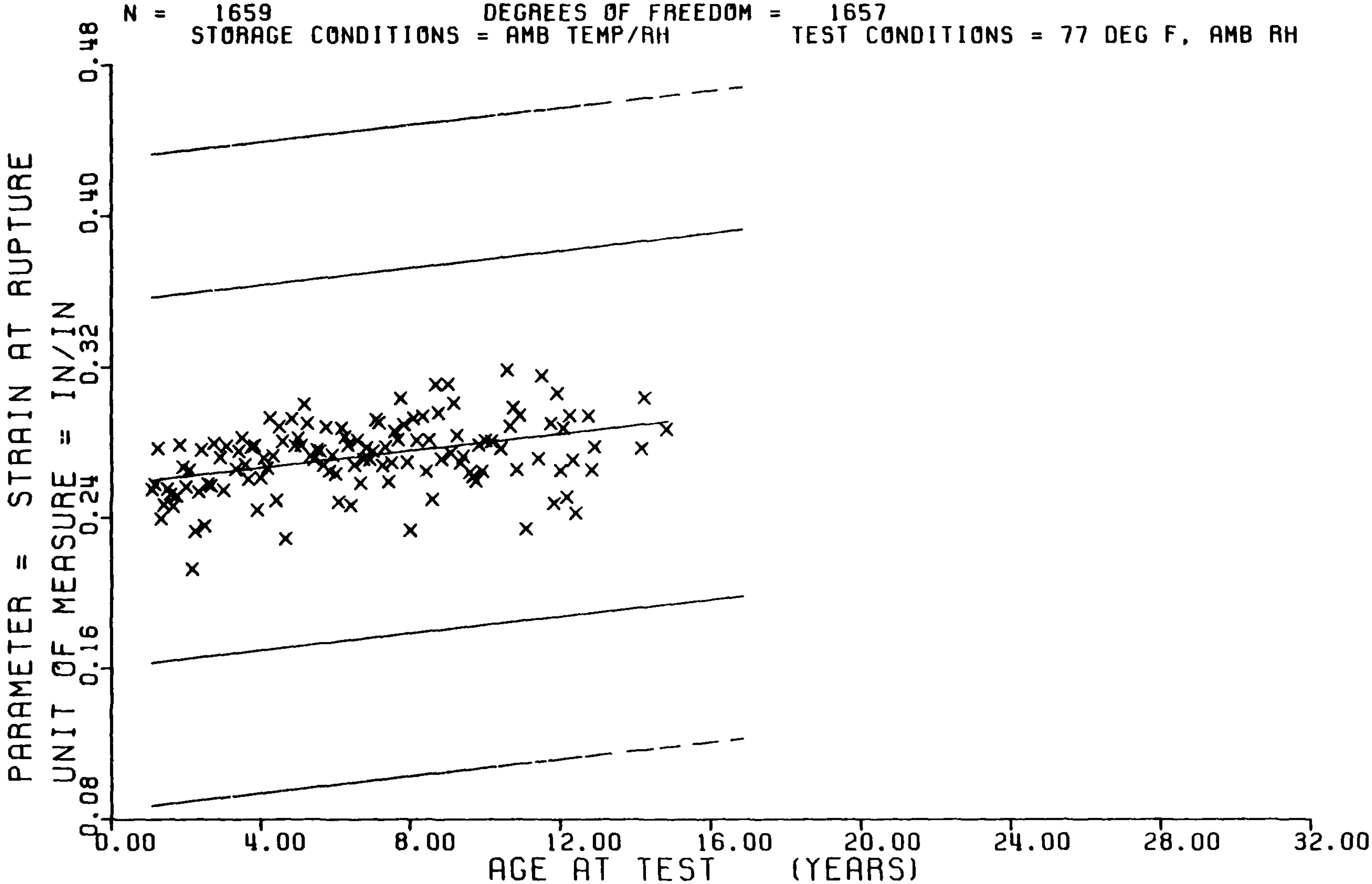
UNIAXIAL TENSILE MAXIMUM STRESS, ANB-3066 (ANB G-POLYMER JNLND), 2 IN/MIN

Figure 4-22

Y = ((+2.5756443E-01) + (+1.8775937E-04) * X)

F = +2.8274961E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_T = +5.8076620E-02
R = +1.2952858E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +3.5310235E-05
ι = +5.3174206E+00 SIGNIFICANCE OF ι = SIGNIFICANT S_ε = +5.7604739E-02
N = 1659 DEGREES OF FREEDOM = 1657

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



UNIAXIAL TENSILE RUPTURE STRAIN, ANB-3066 (ANB G-POLYMER UNLND), 2 IN/MIN

Figure 4-23

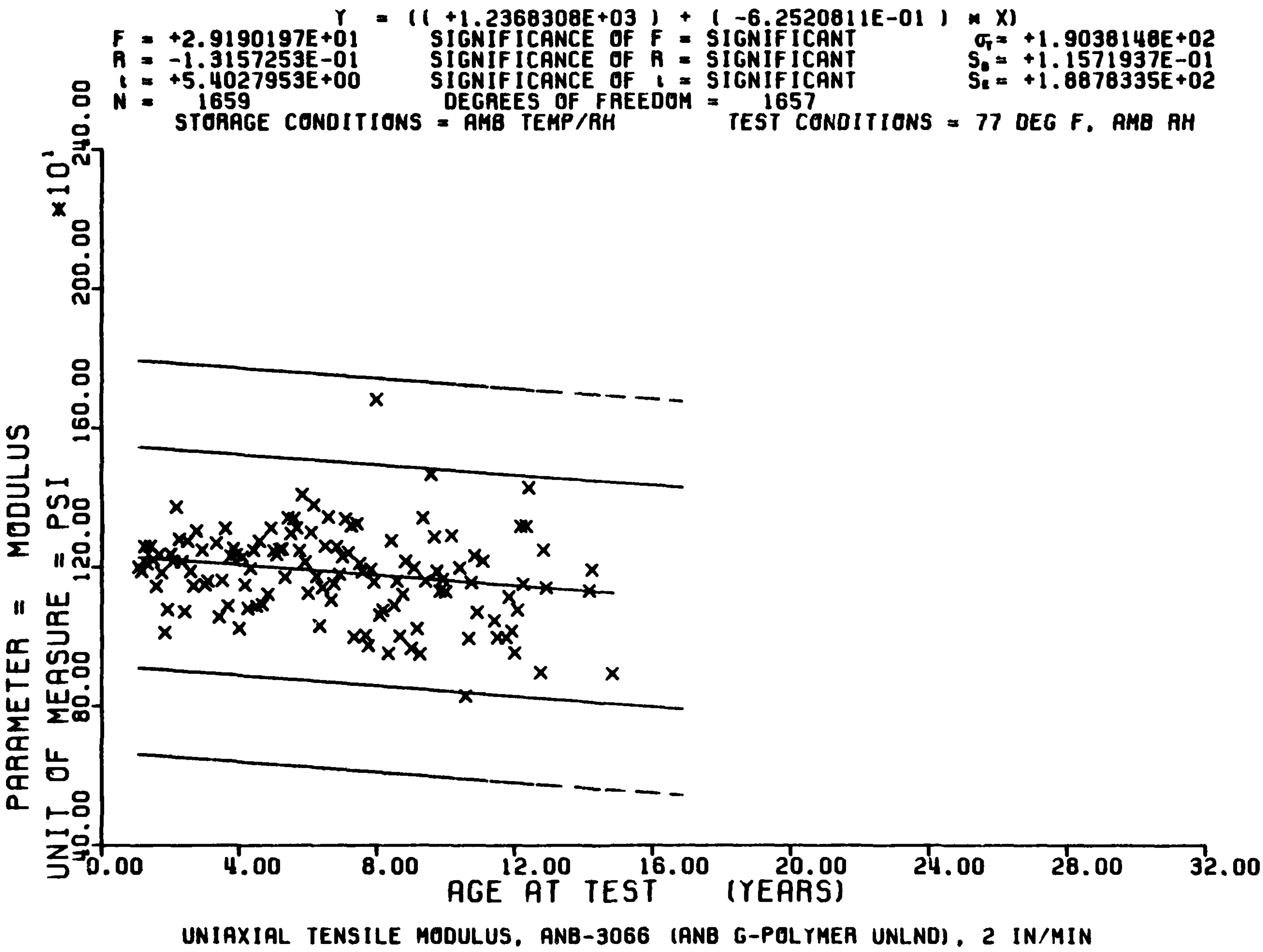
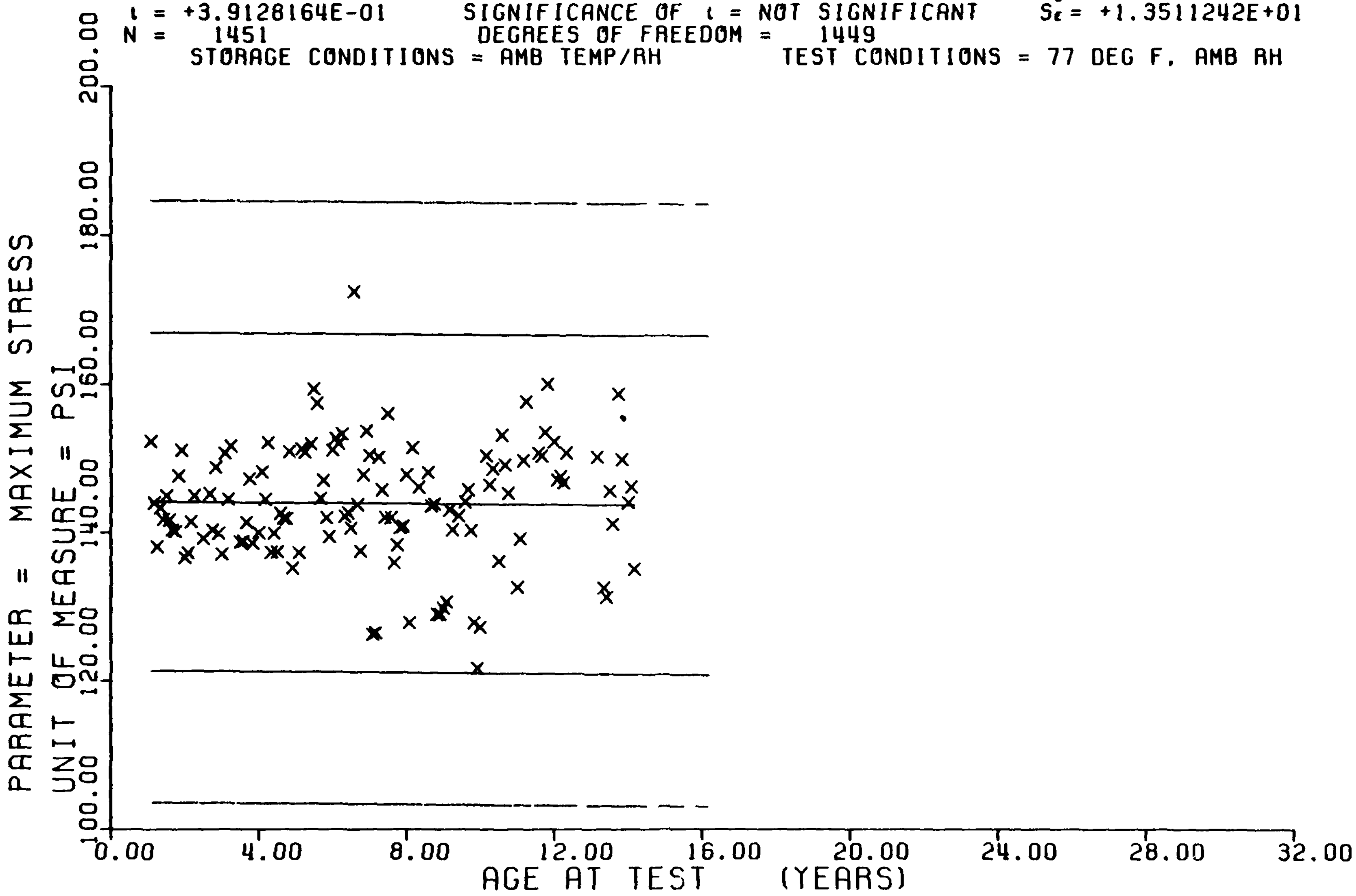

Y = ((+1.2368308E+03) + (-6.2520811E-01) * X)
F = +2.9190197E+01 SIGNIFICANCE OF F = SIGNIFICANT σT = +1.9038148E+02
R = -1.3157253E-01 SIGNIFICANCE OF R = SIGNIFICANT SB = +1.1571937E-01
t = +5.4027953E+00 SIGNIFICANCE OF t = SIGNIFICANT SE = +1.8878335E+02
N = 1659 DEGREES OF FREEDOM = 1657
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH
PARAMETER = MODULUS
UNIT OF MEASURE = PSI
×10¹
40.00
80.00
120.00
160.00
200.00
240.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
UNIAXIAL TENSILE MODULUS, ANB-3066 (ANB G-POLYMER UNLND), 2 IN/MIN

Figure 4-24

Y = ((+1.4420047E+02) + (-3.3263467E-03) * X)

F = +1.5310132E-01 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_Y = +1.3507296E+01
R = -1.0278561E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT S_B = +8.5011571E-03
ι = +3.9128164E-01 SIGNIFICANCE OF ι = NOT SIGNIFICANT S_ε = +1.3511242E+01
N = 1451 DEGREES OF FREEDOM = 1449
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



UNIAXIAL TENSILE MAXIMUM STRESS, ANB-3066 (ANB P-POLYMER UNLND), 2 IN/MIN

Figure 4-25

Y = ((+2.5544062E-01) + (+1.6249627E-05) * X)

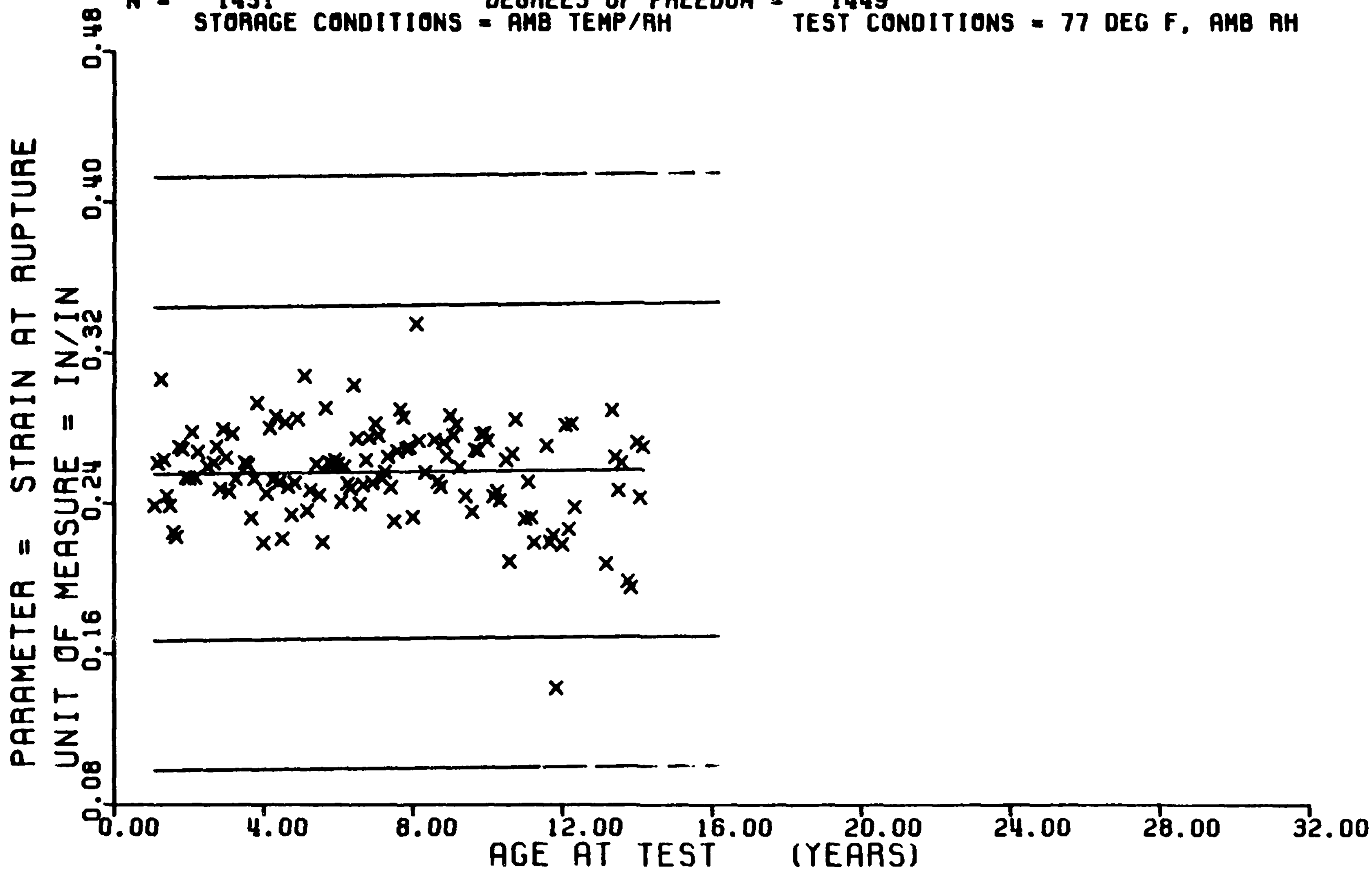
F = +2.4172847E-01 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_T = +5.2514975E-02

R = +1.2914972E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT S_B = +3.3050611E-05

ι = +4.9165890E-01 SIGNIFICANCE OF ι = NOT SIGNIFICANT S_E = +5.2528712E-02

N = 1451 DEGREES OF FREEDOM = 1449

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



UNIAXIAL TENSILE RUPTURE STRAIN, ANB-3066 (ANB P-POLYMER UNLND), 2 IN/MIN

Figure 4-26

Y = ((+1.2584496E+03) + (+8.3908508E-01) * X)

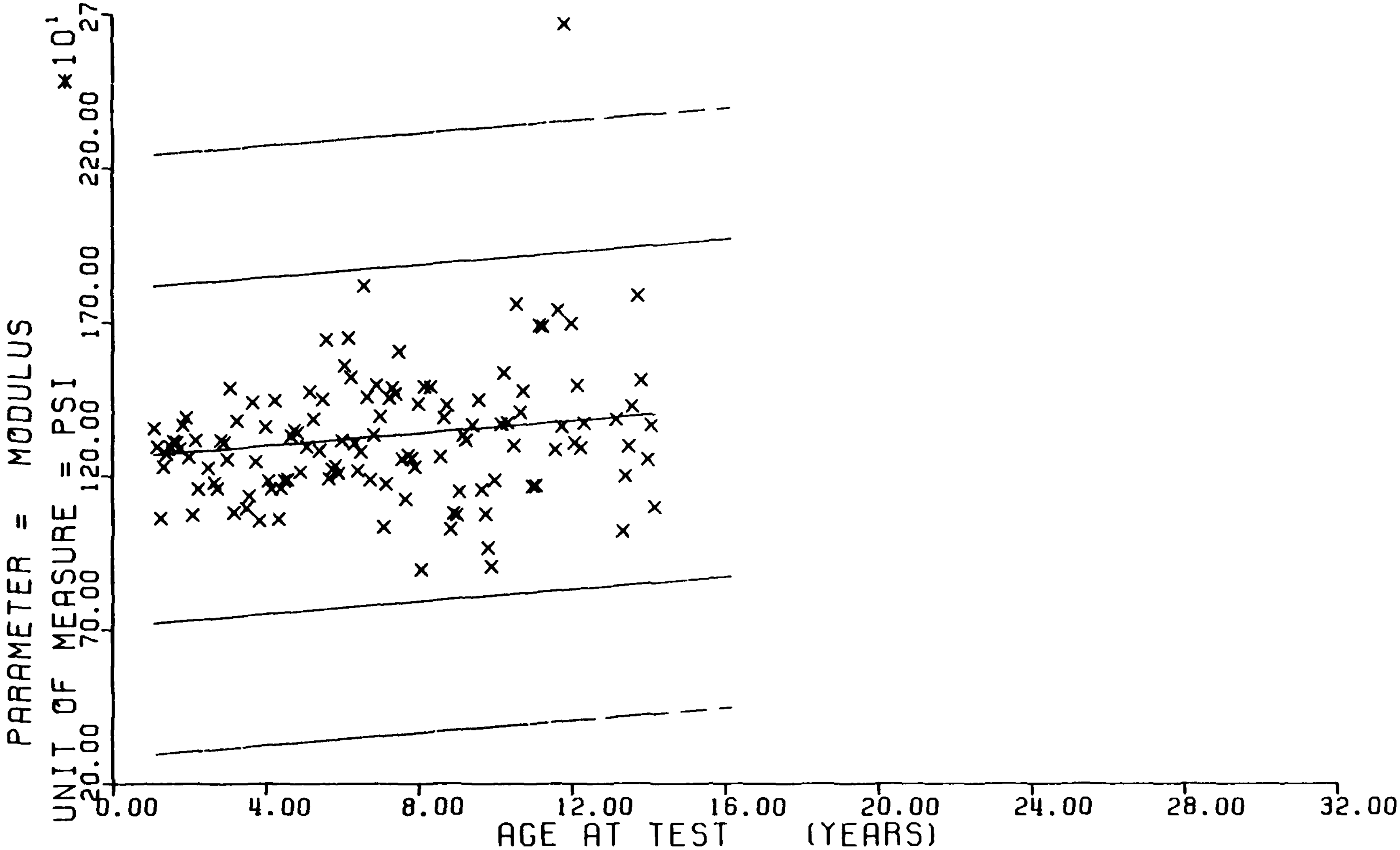
F = +1.6845309E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +3.2669600E+02

R = +1.0720015E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +2.0444029E-01

t = +4.1043037E+00 SIGNIFICANCE OF t = SIGNIFICANT S_E = +3.2492547E+02

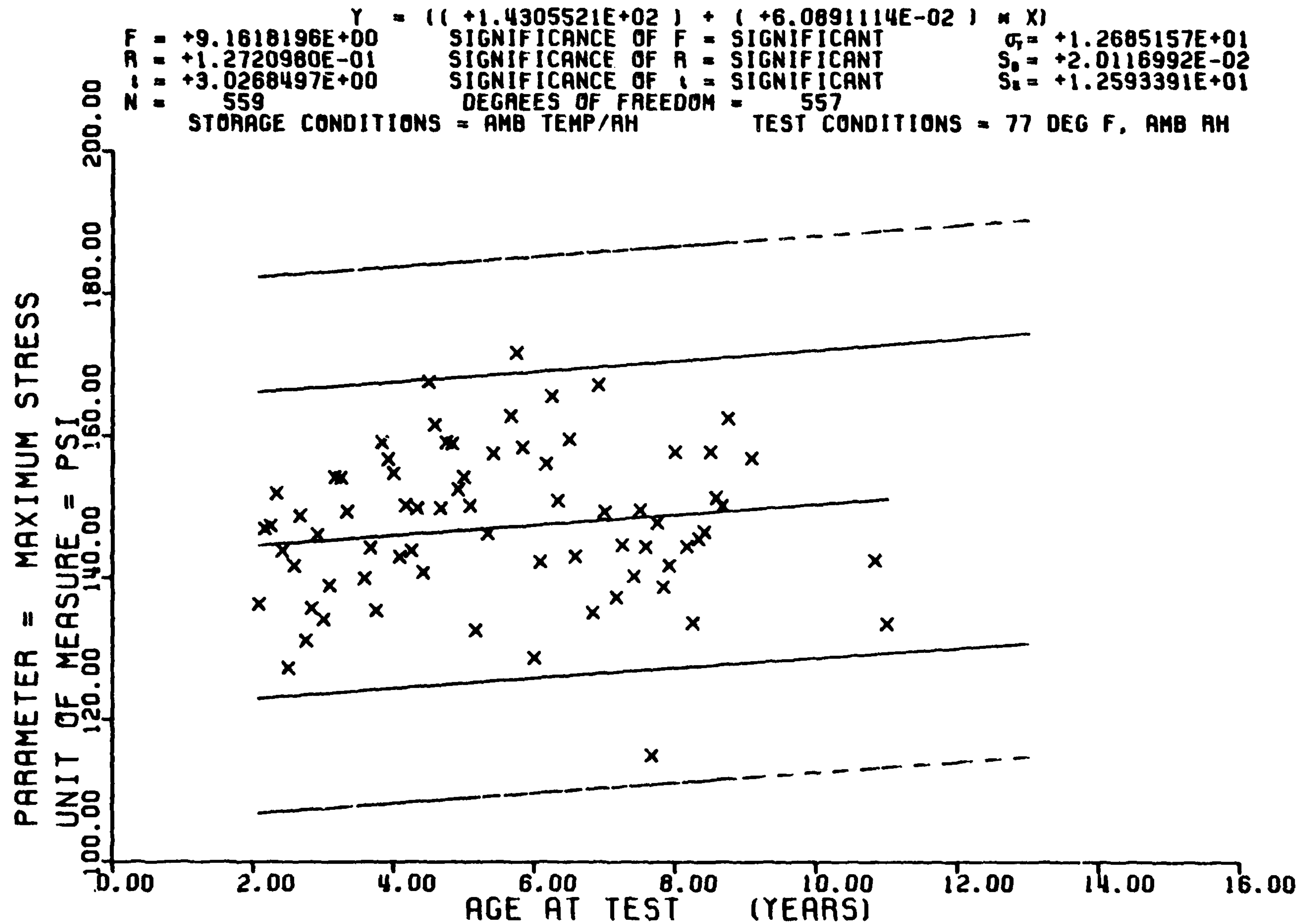
N = 1451 DEGREES OF FREEDOM = 1449

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



UNIAXIAL TENSILE MODULUS, ANB-3066 (ANB P-POLYMER UNLND), 2 IN/MIN

Figure 4-27



UNIAXIAL TENSILE MAXIMUM STRESS, ANB-3066 (ANT P-POLYMER UNLND), 2 IN/MIN

Figure 4-28

Y = ((+2.7531016E-01) + (-2.3283698E-04) * X)

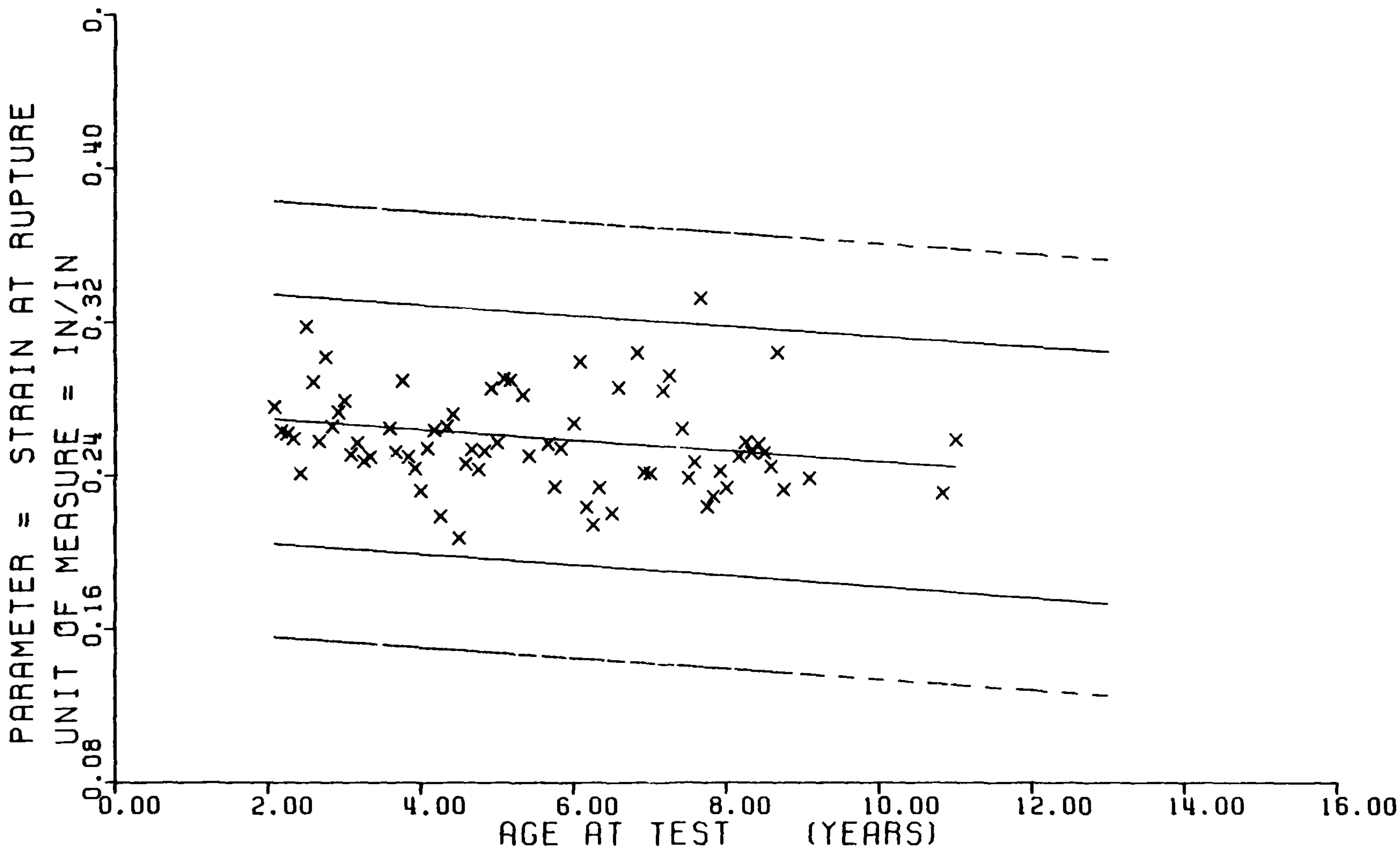
F = +1.4827863E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +3.8318444E-02

R = -1.6102993E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +6.0466200E-05

t = +3.8506964E+00 SIGNIFICANCE OF t = SIGNIFICANT S_E = +3.7852303E-02

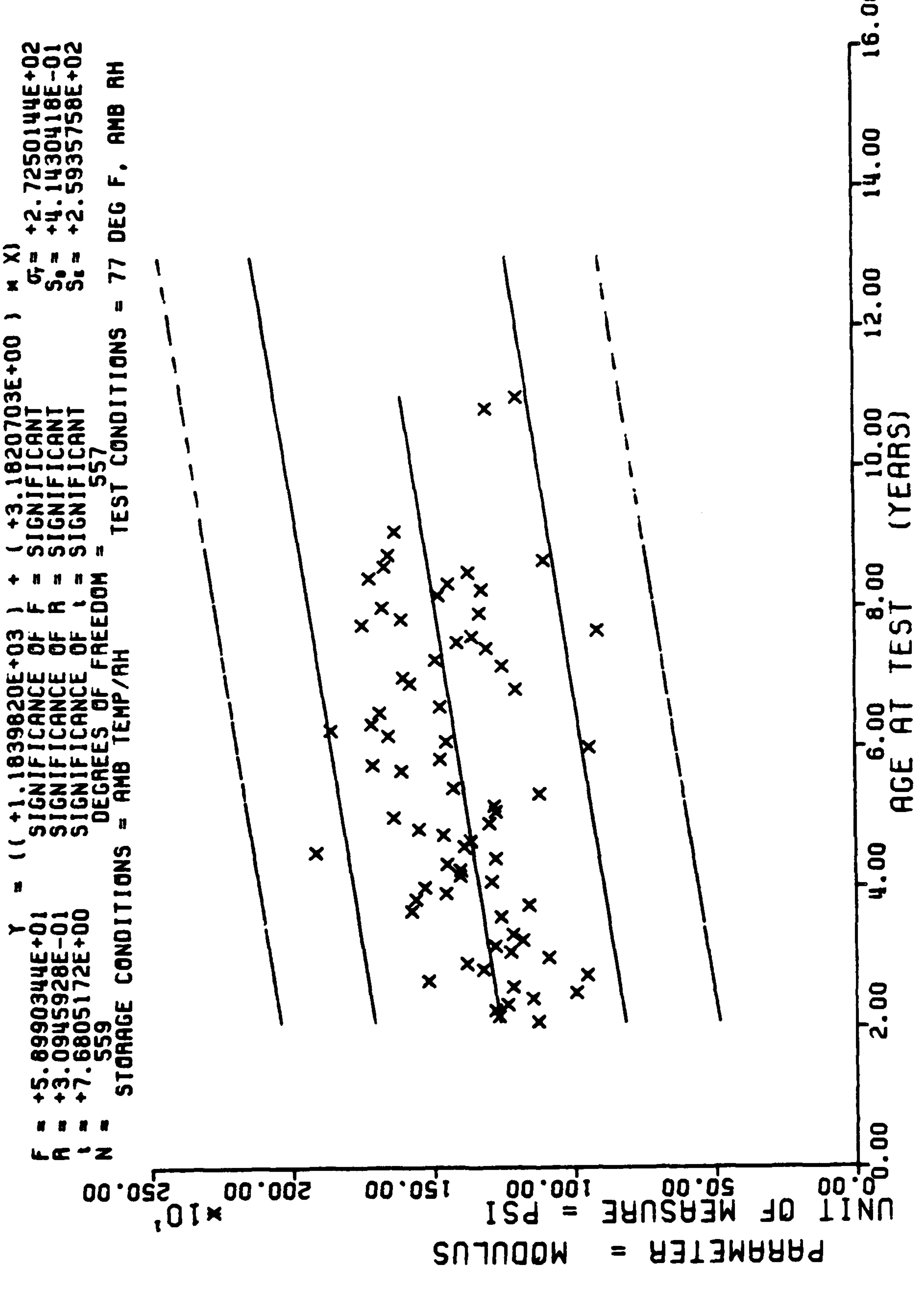
N = 559 DEGREES OF FREEDOM = 557

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



UNIAXIAL TENSILE RUPTURE STRAIN, ANB-3066 (ANT P-POLYMER UNLND), 2 IN/MIN

Figure 4-29



UNIAXIAL TENSILE MODULUS, ANB-3066 (ANT P-POLYMER UNLND), 2 IN/MIN

Figure 4-30

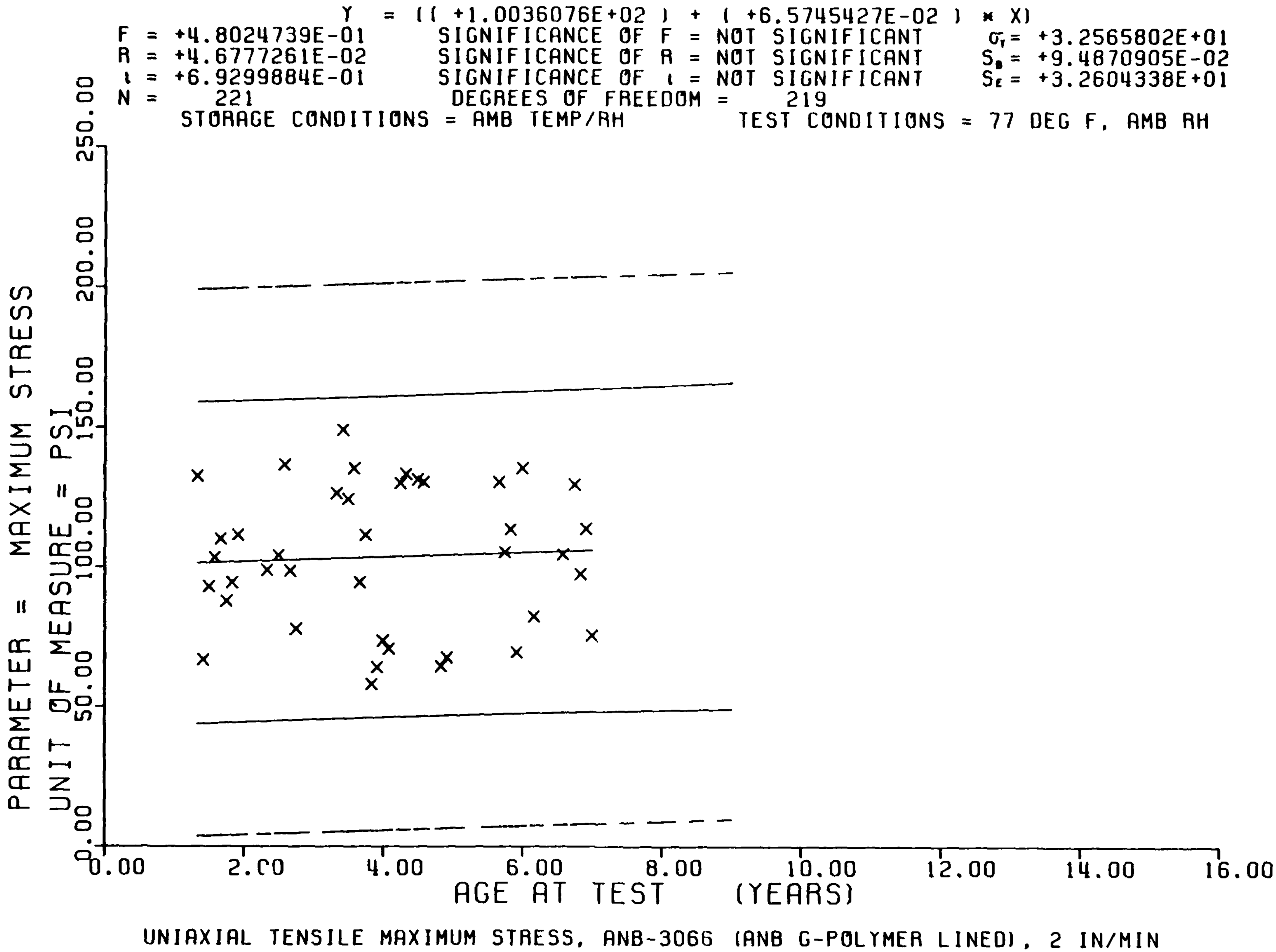
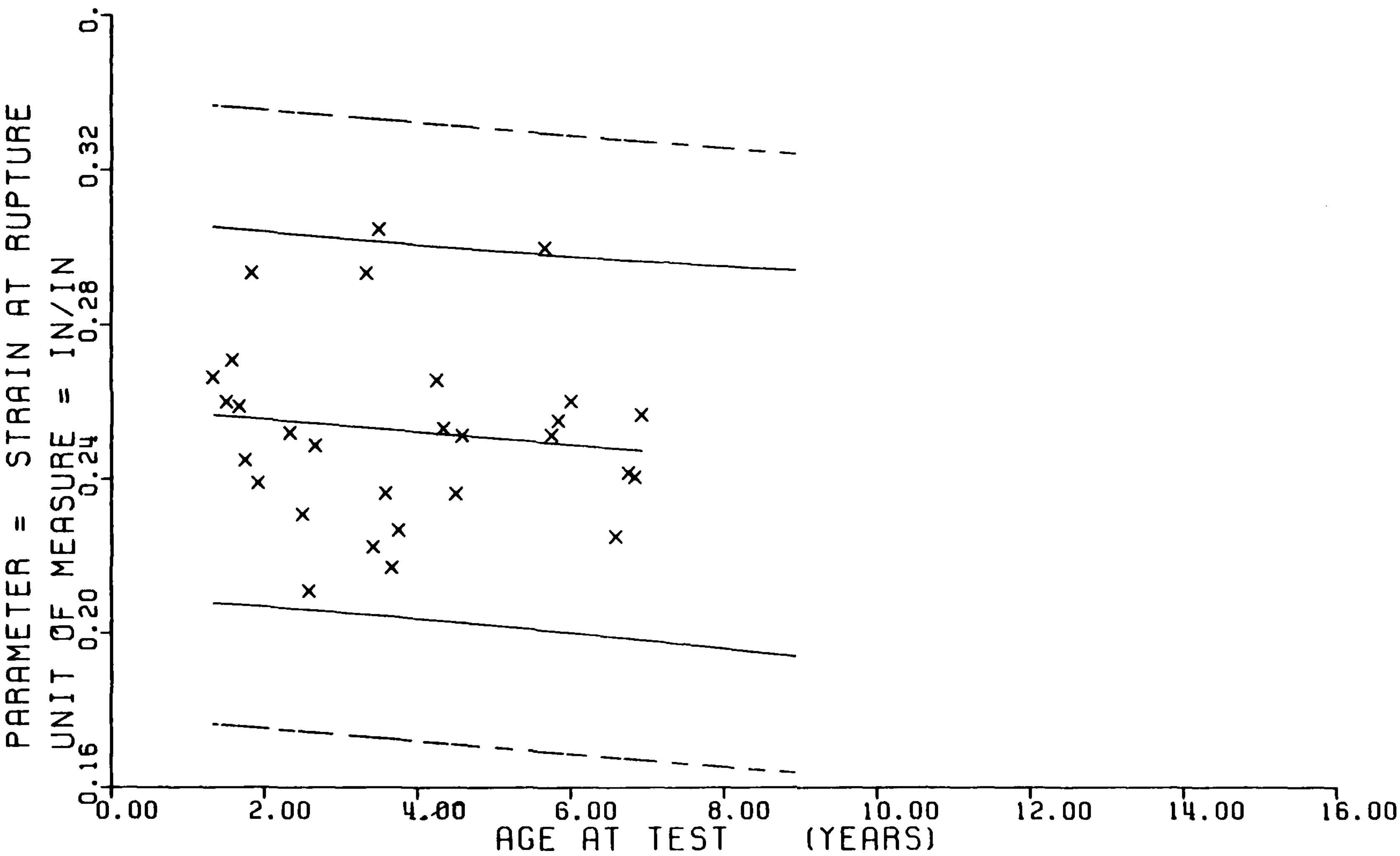

Y = ((+1.0036076E+02) + (+6.5745427E-02) * X)
F = +4.8024739E-01 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_Y = +3.2565802E+01
R = +4.6777261E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT S_B = +9.4870905E-02
ι = +6.9299884E-01 SIGNIFICANCE OF ι = NOT SIGNIFICANT S_E = +3.2604338E+01
N = 221 DEGREES OF FREEDOM = 219
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH
PARAMETER = MAXIMUM STRESS
UNIT OF MEASURE = PSI
0.00
50.00
100.00
150.00
200.00
250.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
AGE AT TEST (YEARS)
UNIAXIAL TENSILE MAXIMUM STRESS, ANB-3066 (ANB G-POLYMER LINED), 2 IN/MIN

Figure 4-31

Y = ((+2.5878748E-01) + (-1.3840093E-04) * X)

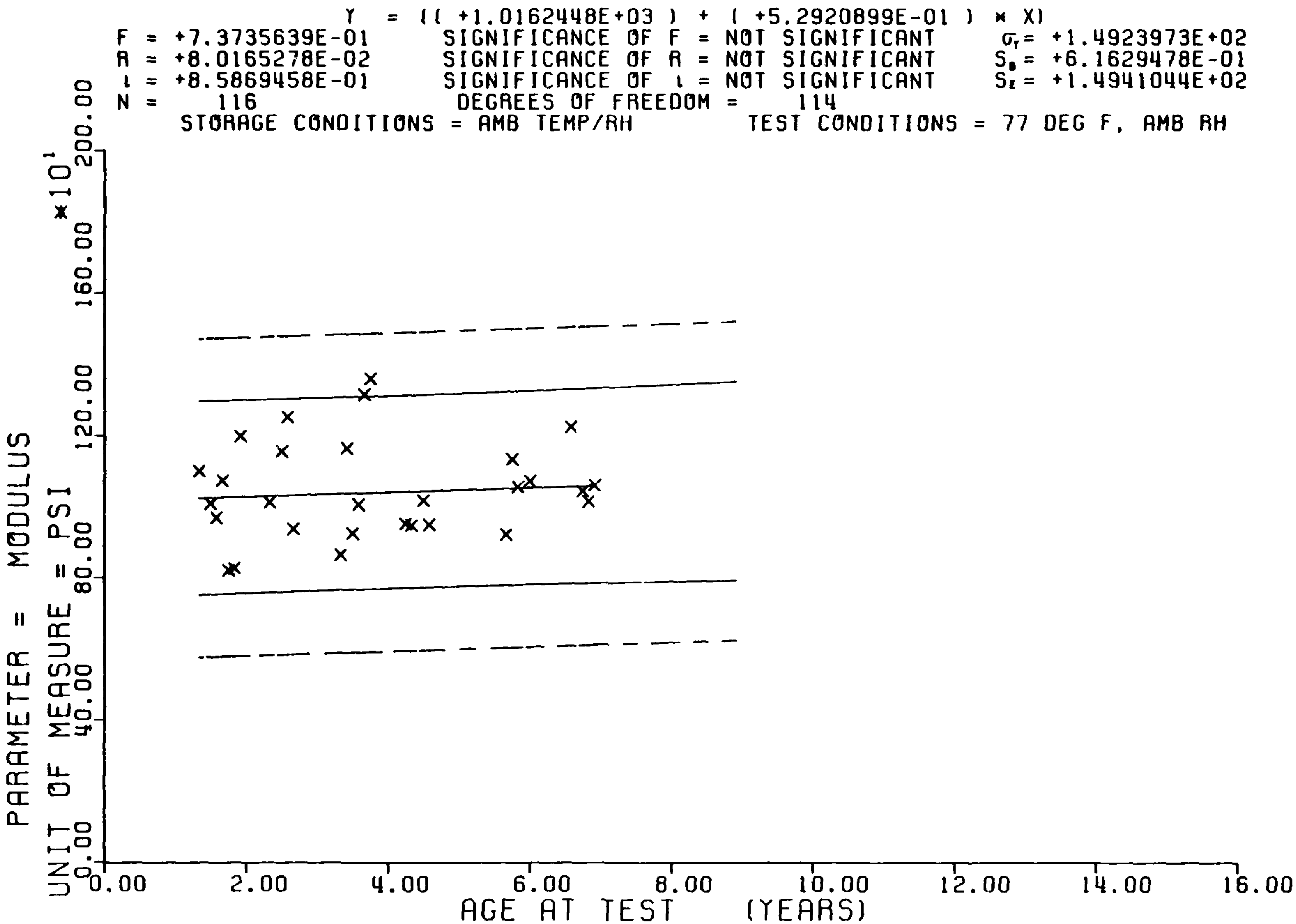
F = +1.5770250E+00 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_T = +2.6785455E-02
R = -1.1681094E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT S_B = +1.1020967E-04
ι = +1.2557965E+00 SIGNIFICANCE OF ι = NOT SIGNIFICANT S_ε = +2.6718507E-02
N = 116 DEGREES OF FREEDOM = 114

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



UNIAXIAL TENSILE RUPTURE STRAIN, ANB-3066 (ANB G-POLYMER LINED), 2 IN/MIN

Figure 4-32



UNIAXIAL TENSILE MODULUS, ANB-3066 (ANB G-POLYMER LINED), 2 IN/MIN

Figure 4-33

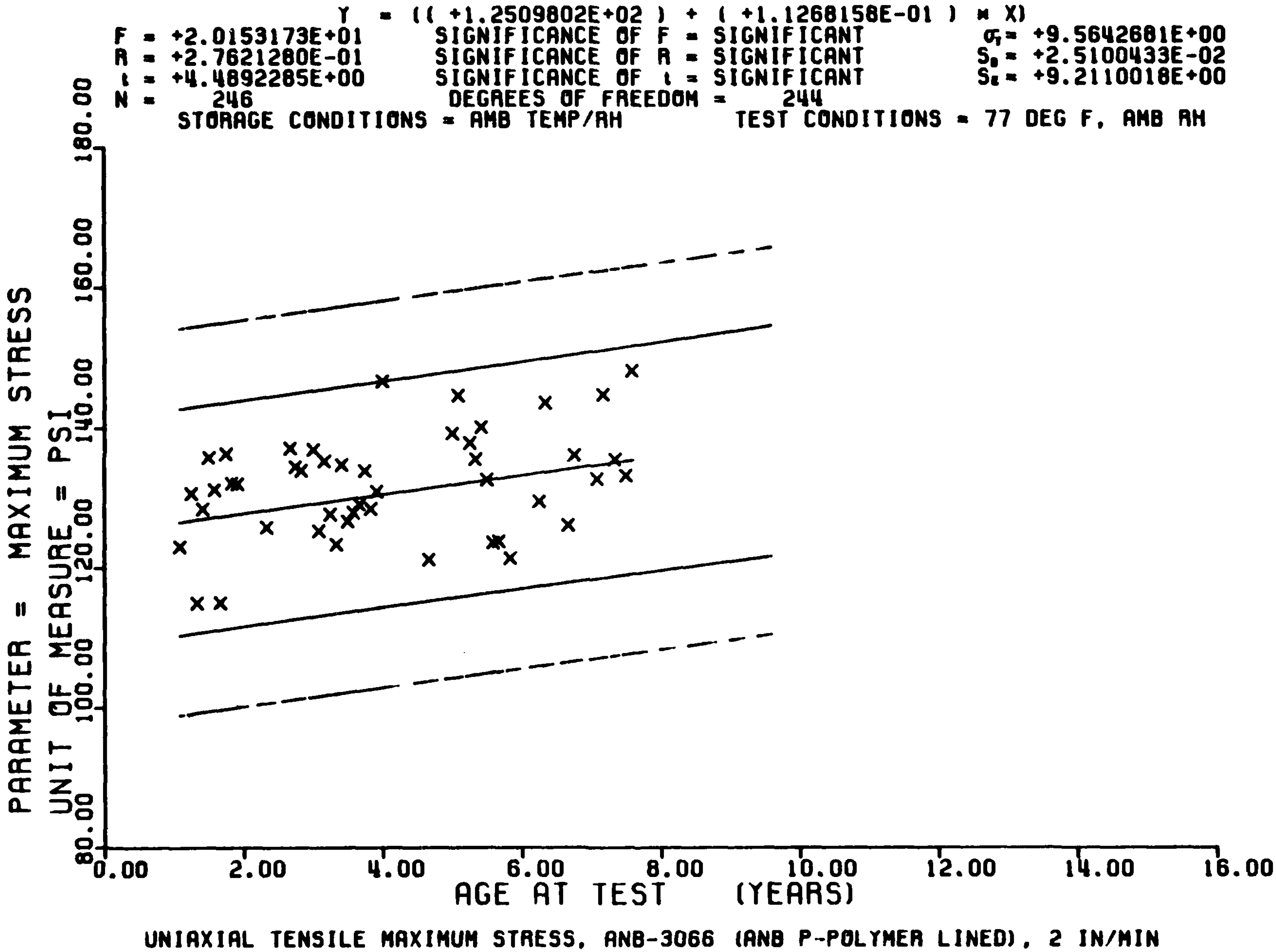
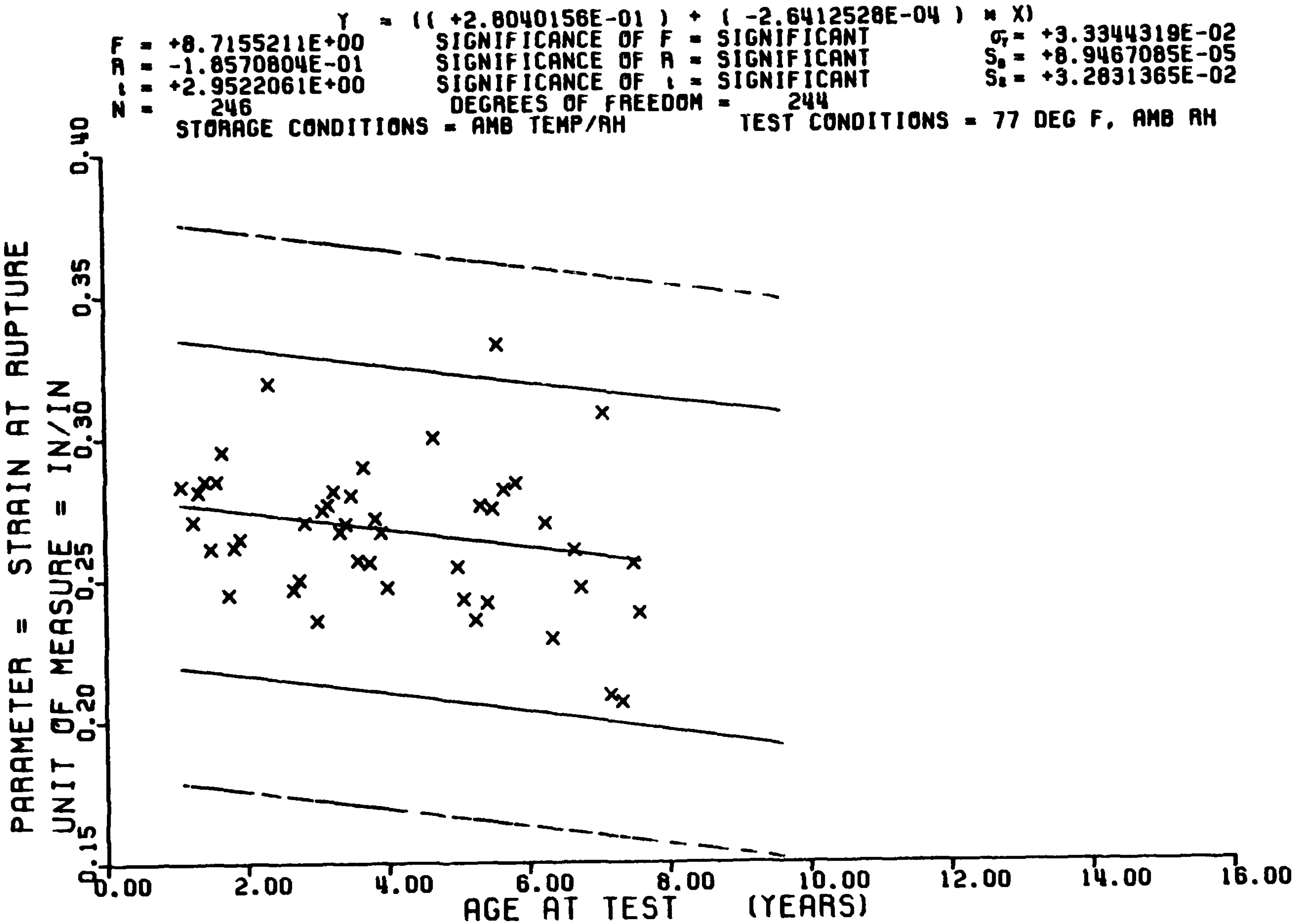

Y = ((+1.2509802E+02) + (+1.1268158E-01) * X)
F = +2.0153173E+01 SIGNIFICANCE OF F = SIGNIFICANT σT = +9.5642681E+00
R = +2.7621280E-01 SIGNIFICANCE OF R = SIGNIFICANT S0 = +2.5100433E-02
t = +4.4892285E+00 SIGNIFICANCE OF t = SIGNIFICANT S1 = +9.2110018E+00
N = 246 DEGREES OF FREEDOM = 244
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH
PARAMETER = MAXIMUM STRESS
UNIT OF MEASURE = PSI
80.00
100.00
120.00
140.00
160.00
180.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
AGE AT TEST (YEARS)
UNIAXIAL TENSILE MAXIMUM STRESS, ANB-3066 (ANB P-POLYMER LINED), 2 IN/MIN

Figure 4-34

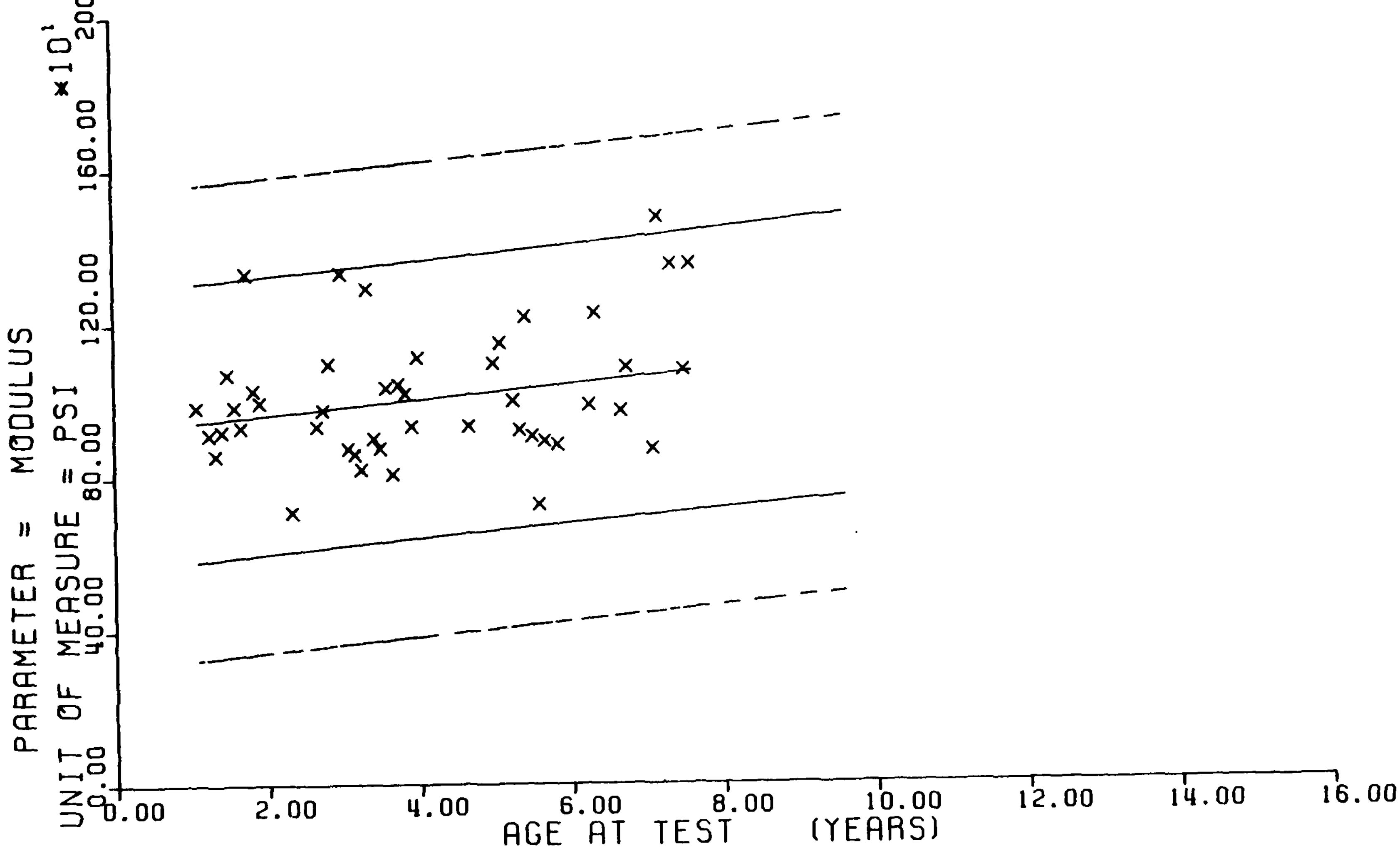


UNIAXIAL TENSILE RUPTURE STRAIN, ANB-3066 (ANB P-POLYMER LINED), 2 IN/MIN

Figure 4-35

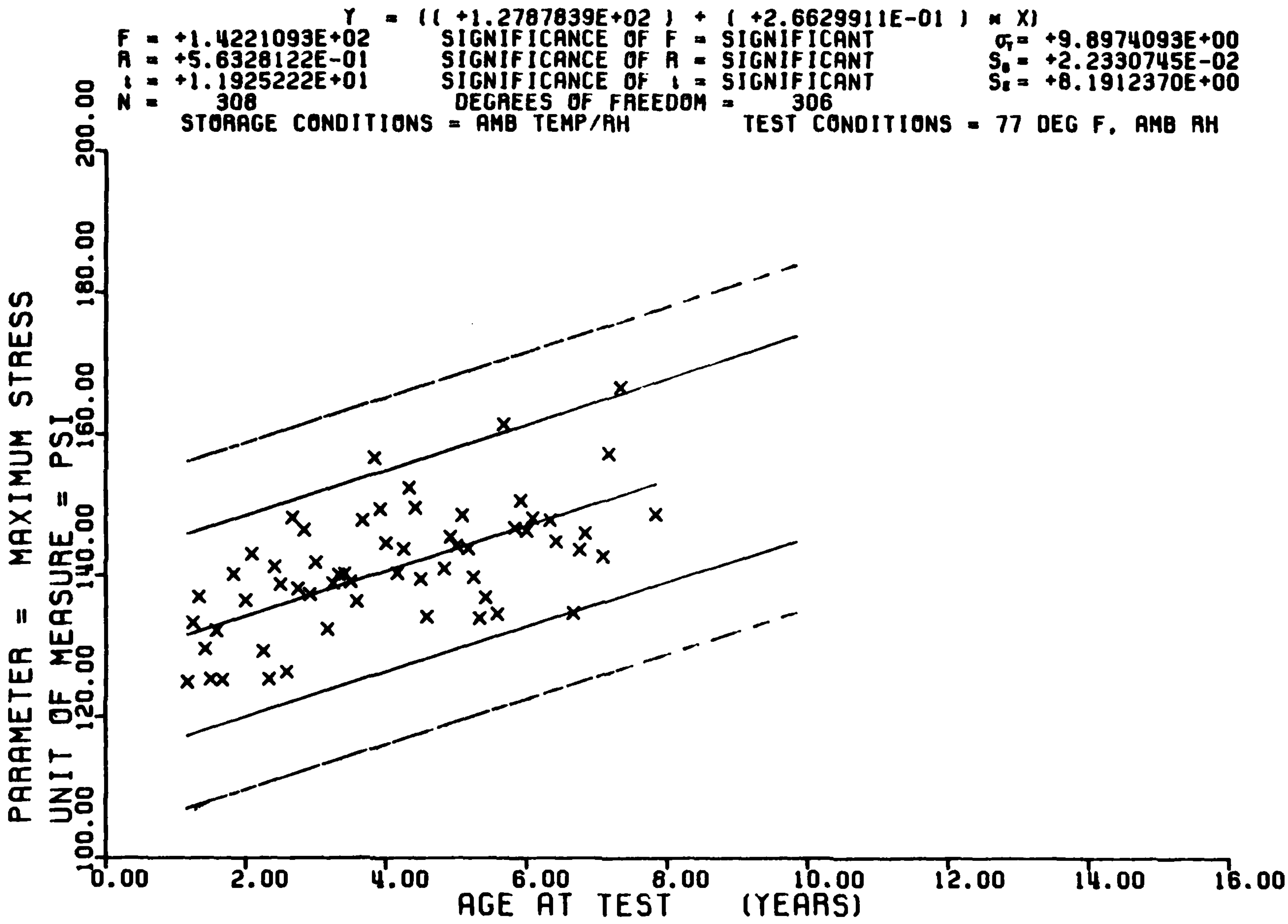
Y = ((+9.2401069E+02) + (+1.6519527E+00) * X)

F = +8.6526130E+00 SIGNIFICANCE OF F = SIGNIFICANT σ_T = +2.0928037E+02
R = +1.8505965E-01 SIGNIFICANCE OF R = SIGNIFICANT S_b = +5.6159598E-01
t = +2.9415324E+00 SIGNIFICANCE OF t = SIGNIFICANT S_E = +2.0608654E+02
N = 246 DEGREES OF FREEDOM = 244
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



UNIAXIAL TENSILE MODULUS, ANB-3066 (ANB P-POLYMER LINED), 2 IN/MIN

Figure 4-36



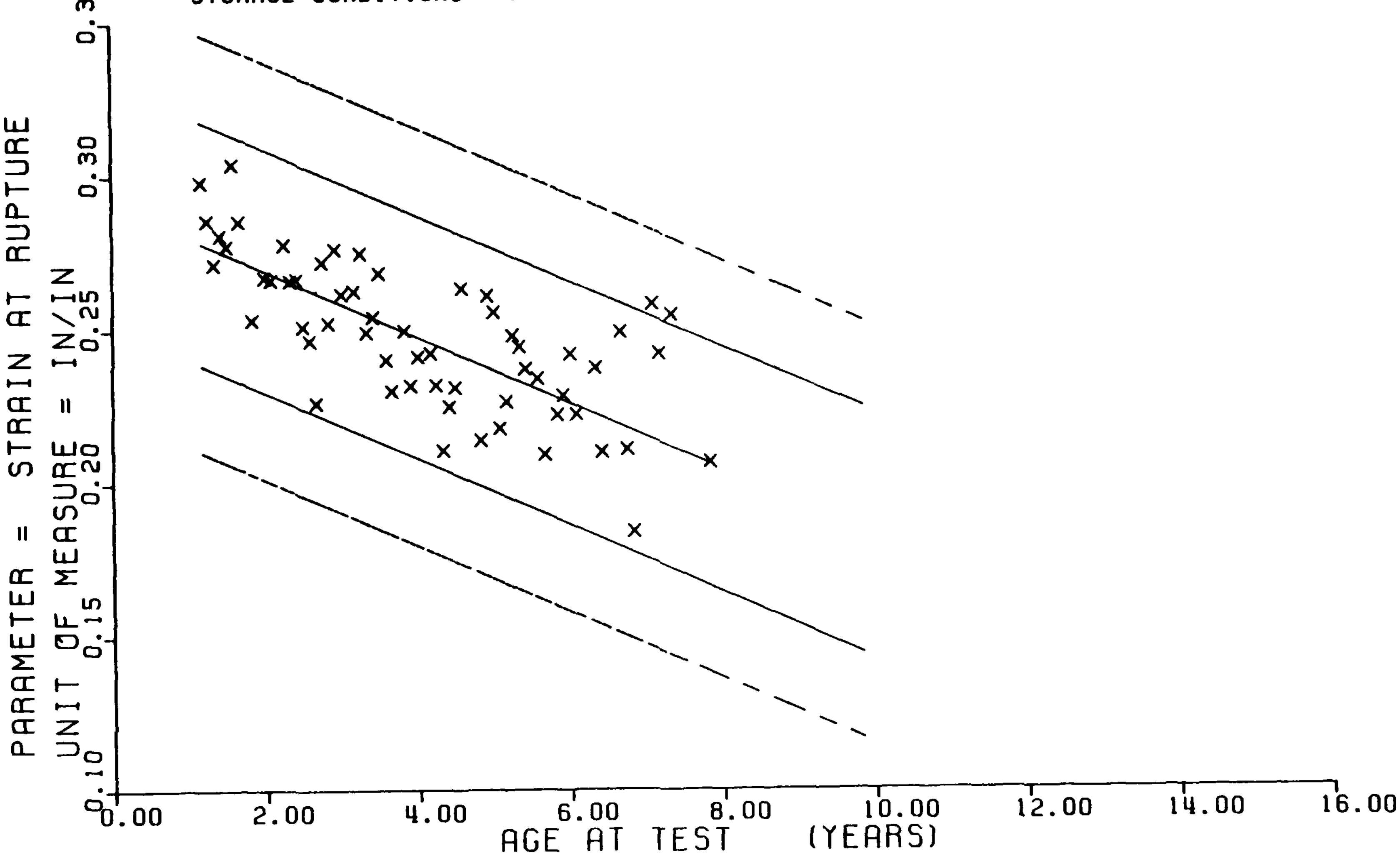
UNIAXIAL TENSILE MAXIMUM STRESS, ANB-3066 (ANT P-POLYMER LINED), 2 IN/MIN

Figure 4-37

Y = ((+2.9092908E-01) + (-9.0340819E-04) * X)

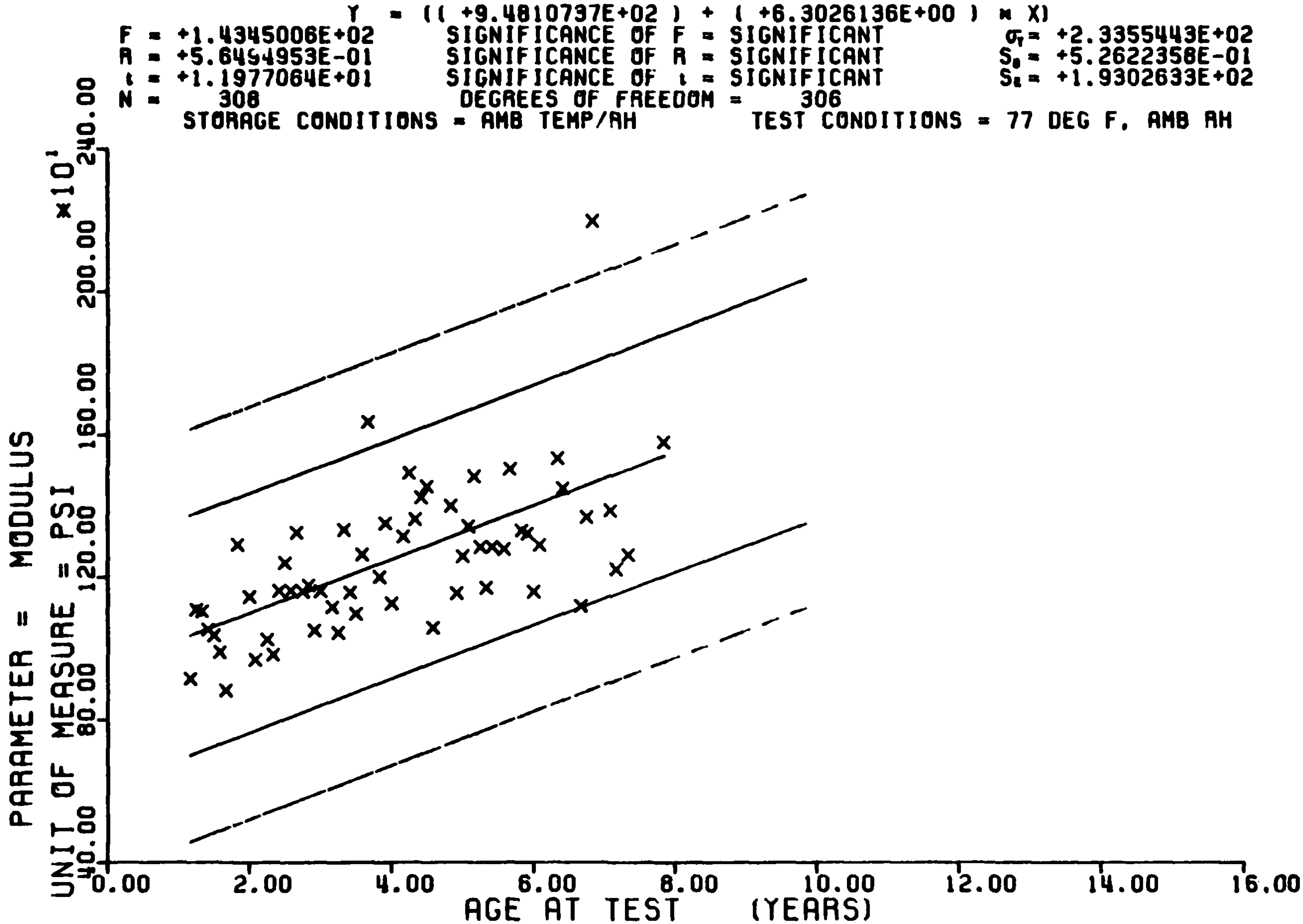
F = +2.1382645E+02   SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +2.9488968E-02
R = -6.4135949E-01   SIGNIFICANCE OF R = SIGNIFICANT S_B = +6.1780768E-05
t = +1.4622805E+01   SIGNIFICANCE OF t = SIGNIFICANT S_E = +2.2662069E-02
N = 308   DEGREES OF FREEDOM = 306

STORAGE CONDITIONS = AMB TEMP/RH   TEST CONDITIONS = 77 DEG F, AMB RH



UNIAXIAL TENSILE RUPTURE STRAIN, ANB-3066 (ANT P-POLYMER LINED), 2 IN/MIN

Figure 4-38



UNIAXIAL TENSILE MODULUS, ANB-3066 (ANT P-POLYMER LINED), 2 IN/MIN

Figure 4-39

SECTION V

HIGH RATE TENSILE

A. High Rate Triaxial:

This test utilizes a specimen 3/4 inch (1.9 cm) GL rail by 5 inches (12.7 cm) long. The specimens are tested on the MTS at a crosshead speed of 1750 in/min (74.08 cm/sec) with 600 psi (42.18 kg/sq cm). Strain rate is 1000 in/in/min. These conditions simulate that of the motor at ignition. Only ANT P lined cartons show significant trends in all parameters (Figures 5-13 to 5-15). Less than one-half of all parameters are statistically significant. No regressions can be combined.

B. High Rate Dogbones:

This test is performed under the same conditions as the rail specimens. The specimens are shortened dogbones with a nominal gage length of 0.75".

All systems show a significant increase in maximum stress. Modulus shows a significant increase except for ANB P lined cartons. Only ANB G lined cartons do not show a significant decrease in strain at rupture (Table 5-2).

Composite regressions have been made for strain at rupture. Only these conditions do not show statistically significant variance.

TABLE 5-1

HIGH RATE TRIAXIAL

Significance of Regression Slopes

System	Sm	Fig	er	Fig	E	Fig
ANB G Unlined	NS	5-1	Sig inc	5-2	Sig dec	5-3
ANB P Unlined	NS	5-4	NS	5-5	Sig dec	5-6
ANT P Unlined	Sig inc	5-7	NS	5-8	NS	5-9
ANB G Lined	NS	5-10	Sig inc	5-11	NS	5-12
ANB P Lined	NS		NS		NS	
ANT P Lined	Sig inc	5-13	Sig dec	5-14	Sig inc	5-15

TABLE 5-2

HIGH RATE HYDROSTATIC

Significance of Regression Slopes

System	Sm	Fig	er	Fig	E	Fig
ANB G Unlined	Sig inc	5-16	Sig dec	5-17	Sig inc	5-18
ANB P Unlined	Sig inc	5-19	Sig dec	5-20	Sig inc	5-21
ANT P Unlined	Sig inc	5-22	Sig dec	5-23	Sig inc	5-24
ANB G Lined	Sig inc	5-25	NS	5-26	Sig inc	5-27
ANB P Lined	Sig inc	5-28	Sig dec	5-29	NS	5-30
ANT P Lined	Sig inc	5-31	Sig dec	5-32	Sig inc	5-33
ANB G vs P Lined			Sig dec	5-34		
ANB vs ANT P Lined			Sig dec	5-35		
ANB G vs ANT P Lined			Sig dec	5-36		

TABLE 5-3

ANALYSIS OF COVARIANCE COMPARISON OF REGRESSIONS
HIGH RATE TRIAXIAL TENSILE (1750 in/min, 600 psi)

		Sm	Er	E
Lined Vs Unlined				
ANB P-polymer	Residual Variance	NS	S	S
	Slope	NS	NS	S
	Elevation	S	S	S
ANB G-polymer	Residual Variance	S	S	S
	Slope	NS	NS	NS
	Elevation	NS	S	S
ANT P-polymer	Residual Variance	NS	S	S
	Slope	NS	S	S
	Elevation	S	S	NS
ANB P Unlined Vs ANT P Lined	Residual Variance	S	S	S
	Slope	S	S	S
	Elevation	NS	S	S
G-polymer Vs P-polymer				
ANB Lined	Residual Variance	S	S	NS
	Slope	NS	S	S
	Elevation	NS	NS	NS
ANB Unlined	Residual Variance	NS	NS	NS
	Slope	NS	S	NS
	Elevation	S	S	S
ANB G Unlined Vs ANT P Unlined	Residual Variance	S	NS	S
	Slope	S	S	S
	Elevation	S	S	S
ANB G Lined Vs ANT P Lined	Residual Variance	NS	NS	NS
	Slope	S	S	S
	Elevation	S	S	S
ANB P-polymer Vs ANT P-polymer				
Lined	Residual Variance	S	NS	NS
	Slope	S	S	S
	Elevation	S	S	S
Unlined	Residual Variance	S	NS	S
	Slope	NS	NS	S
	Elevation	S	S	S

Y = ((+5.7021717E+02) + (-5.6865838E-02) * X)

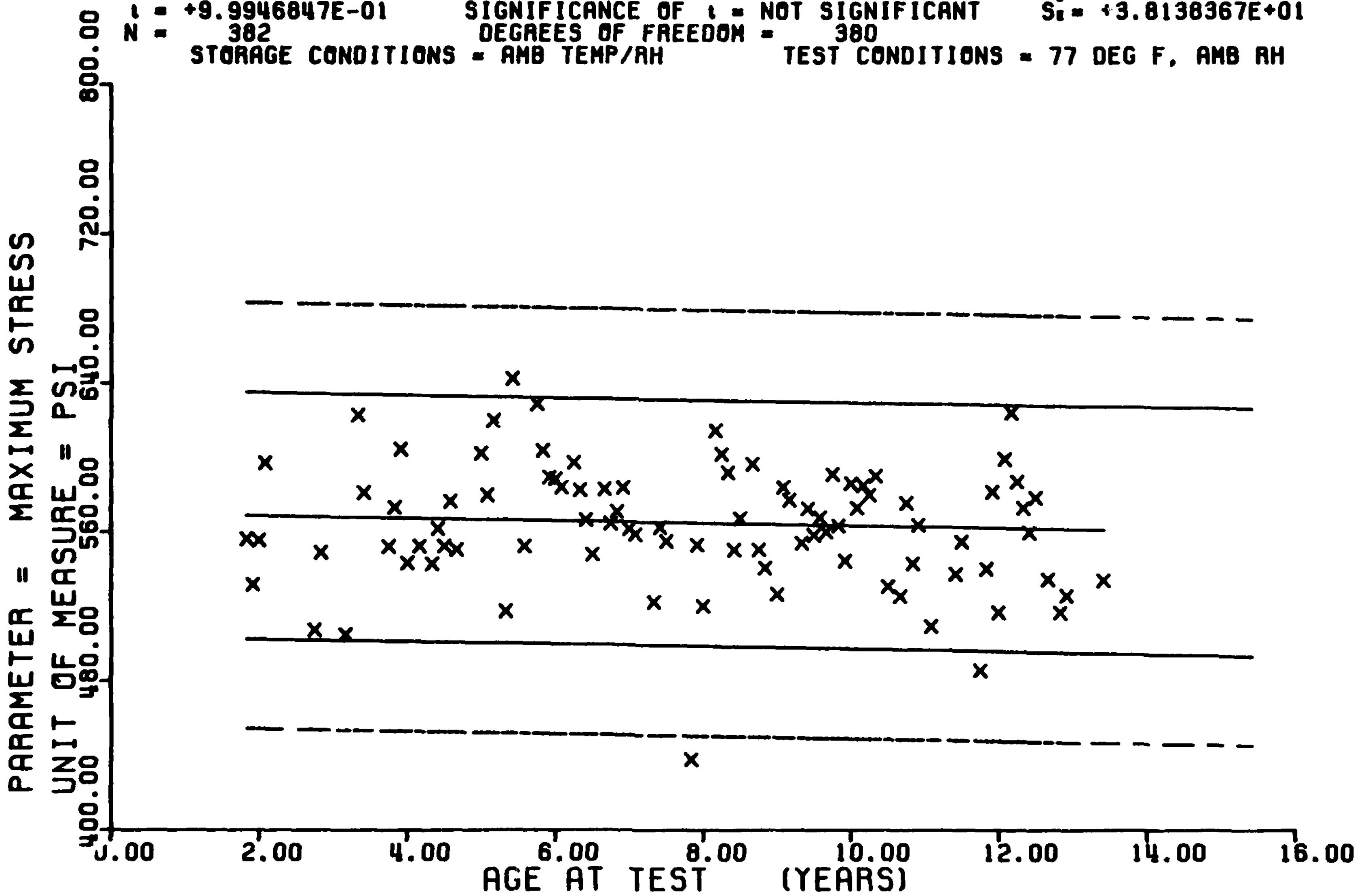
F = +9.9893723E-01 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_T = +3.8138314E+01

R = -5.1204392E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT S_b = +5.6896080E-02

ι = +9.9946847E-01 SIGNIFICANCE OF ι = NOT SIGNIFICANT S_E = +3.8138367E+01

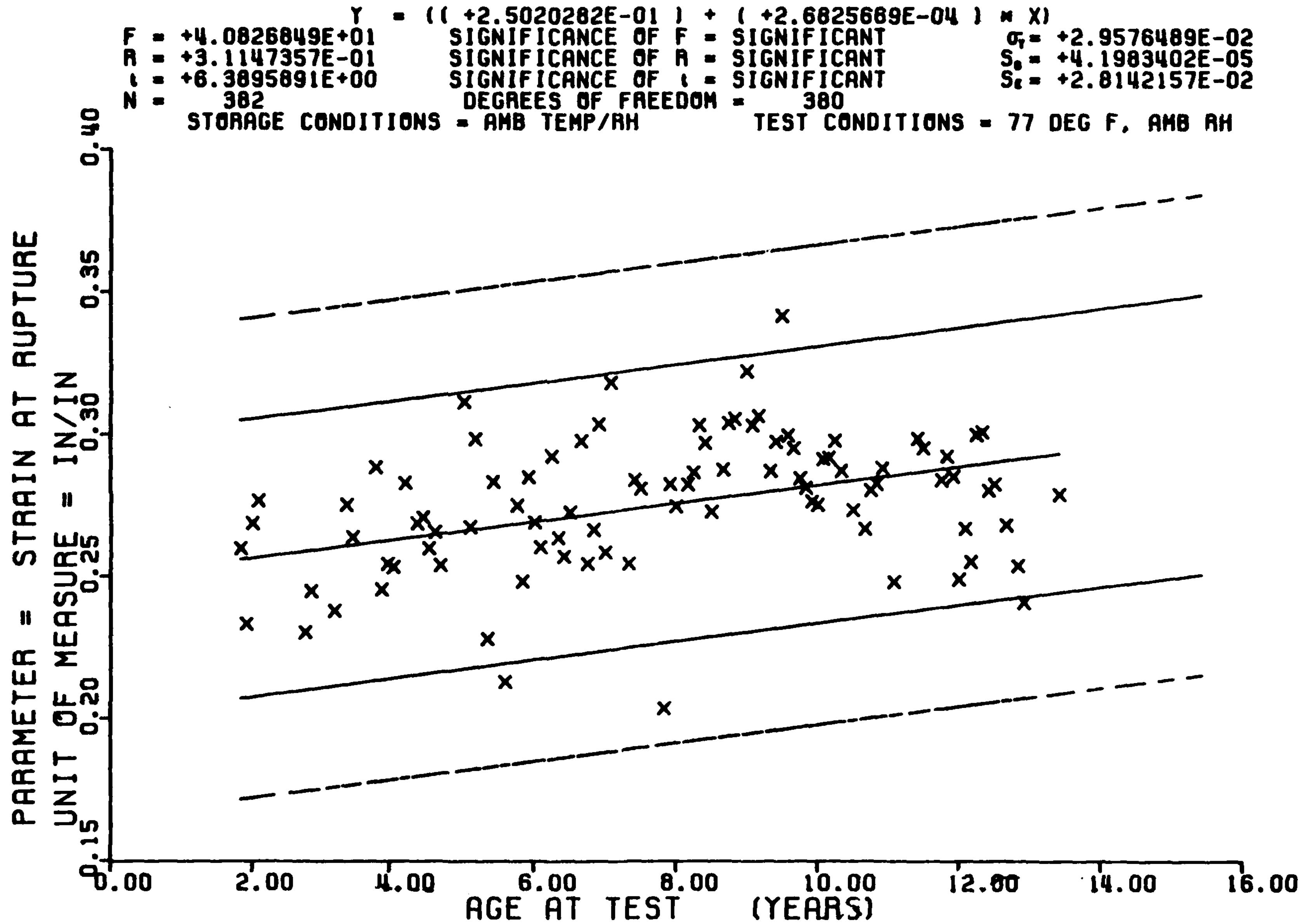
N = 382 DEGREES OF FREEDOM = 380

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



TENSILE TRIAX MAX STRESS, HNB-3066 (ANB G-POLYMER UNLND), 1750 IN/MIN, 600 PSI

Figure 5-1



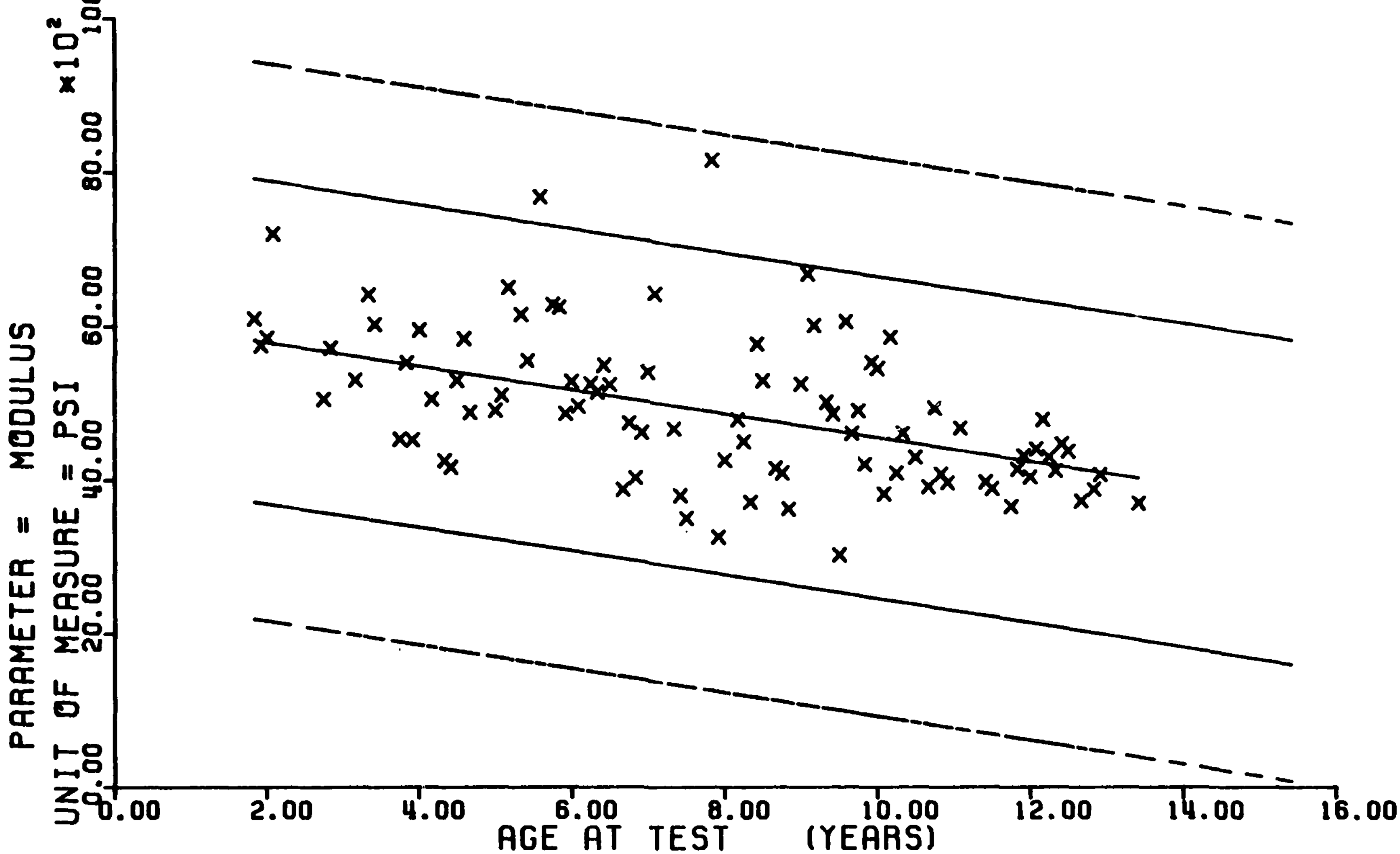
TENSILE TRIAX RUP STRAIN, ANB-3066 (ANB G-POLYMER UNLND), 1750 IN/MIN, 600 PSI

Figure 5-2

Y = ((+6.1003915E+03) + (-1.2967454E+01) * X)

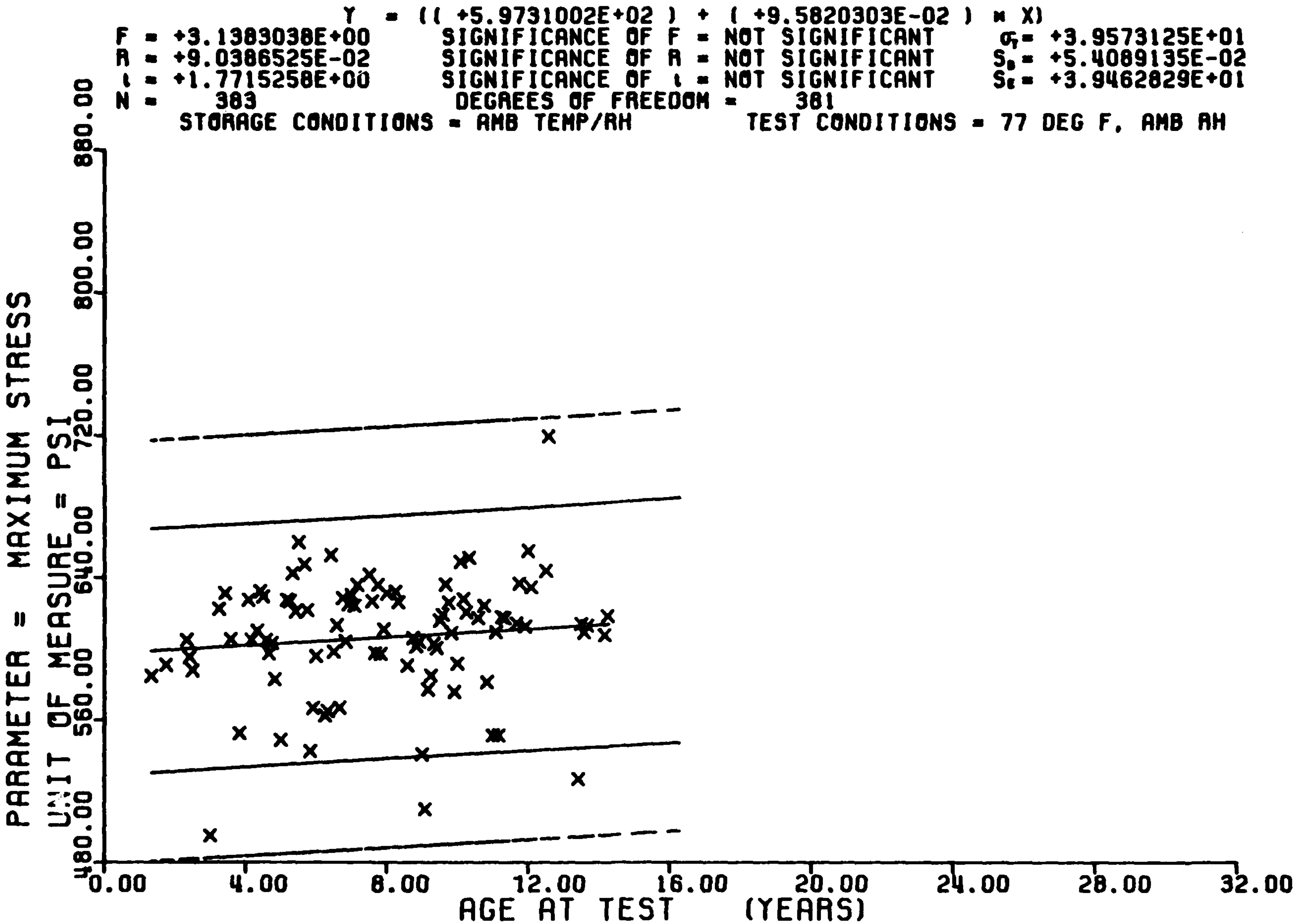
F = +5.1771188E+01   SIGNIFICANCE OF F = SIGNIFICANT σ_T = +1.2860408E+03
R = -3.4627189E-01   SIGNIFICANCE OF R = SIGNIFICANT S_B = +1.8022319E+00
t = +7.1952198E+00   SIGNIFICANCE OF t = SIGNIFICANT S_E = +1.2080653E+03
N = 382   DEGREES OF FREEDOM = 380

STORAGE CONDITIONS = AMB TEMP/RH   TEST CONDITIONS = 77 DEG F, AMB RH



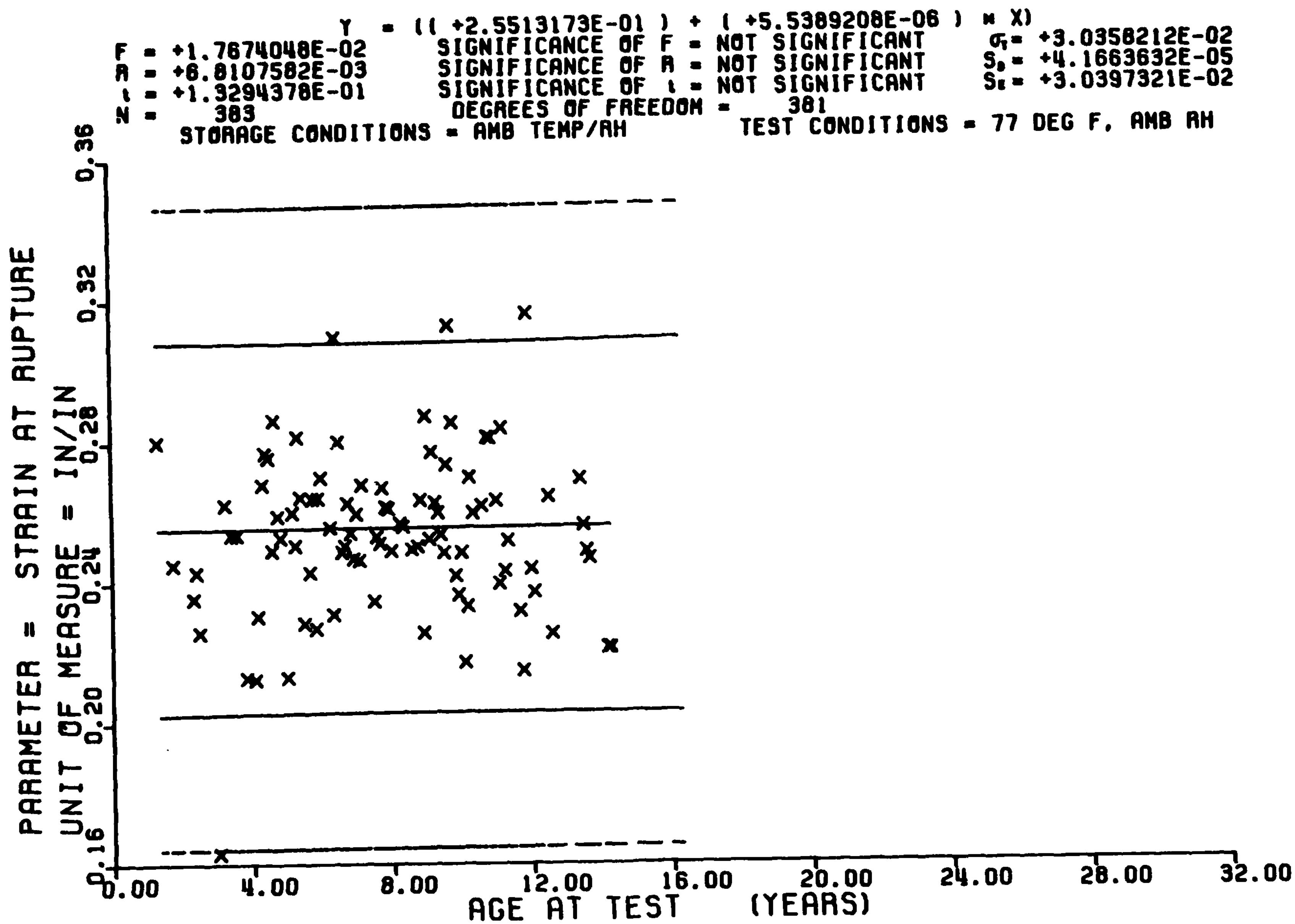
TENSILE TRIAX MODULUS, ANB-3066 (ANB G-POLYMER UNLINED), 1750 IN/MIN, 600 PSI

Figure 5-3



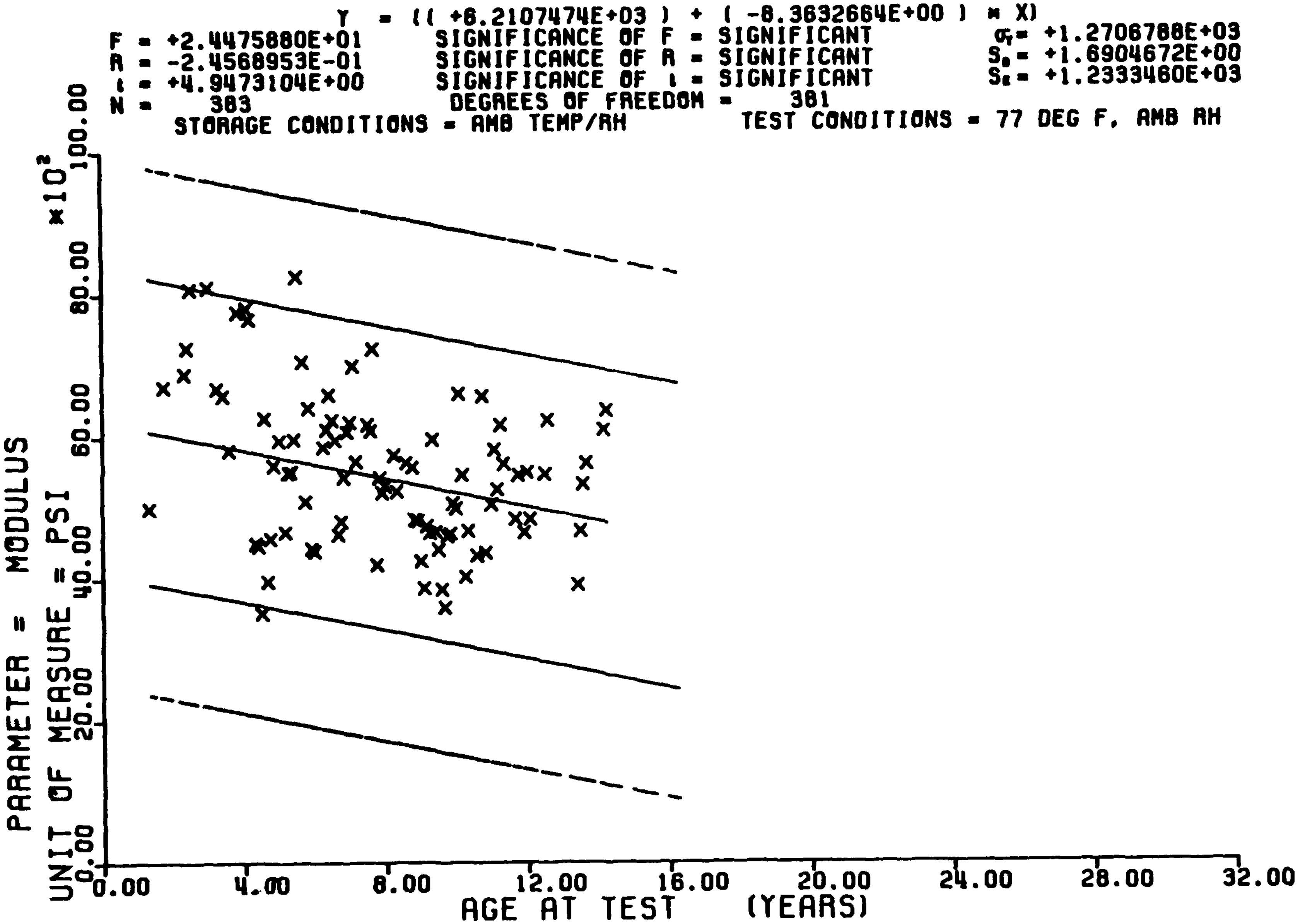
TENSILE TRIAX MAX STRESS, ANB-3066 (ANB P-POLYMER UNLND), 1750 IN/MIN, 600 PSI

Figure 5-4



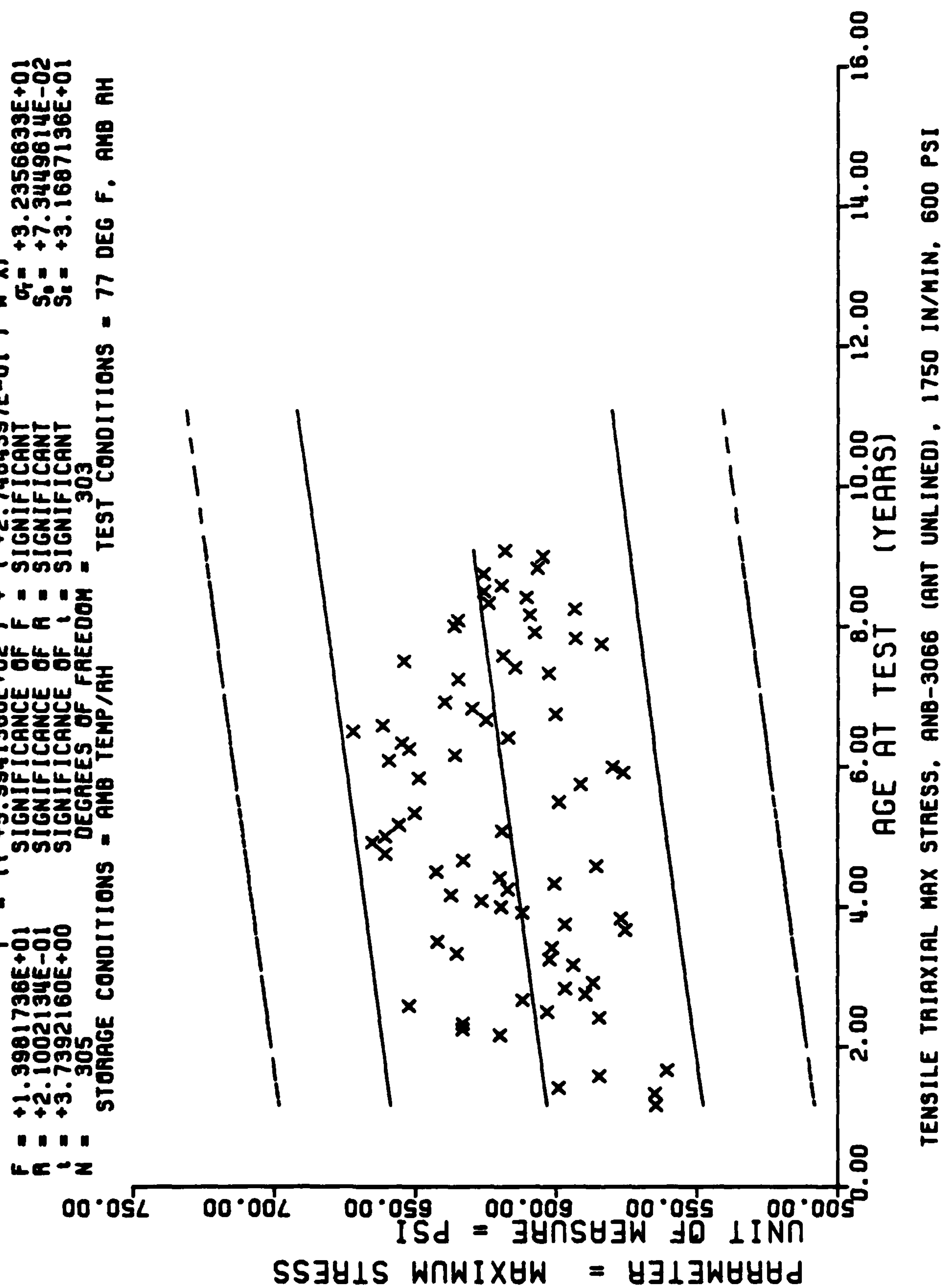
TENSILE TRIAX RUP STRAIN, ANB-3066 (ANB P-POLYMER UNLND), 1750 IN/MIN, 600 PSI

Figure 5-5



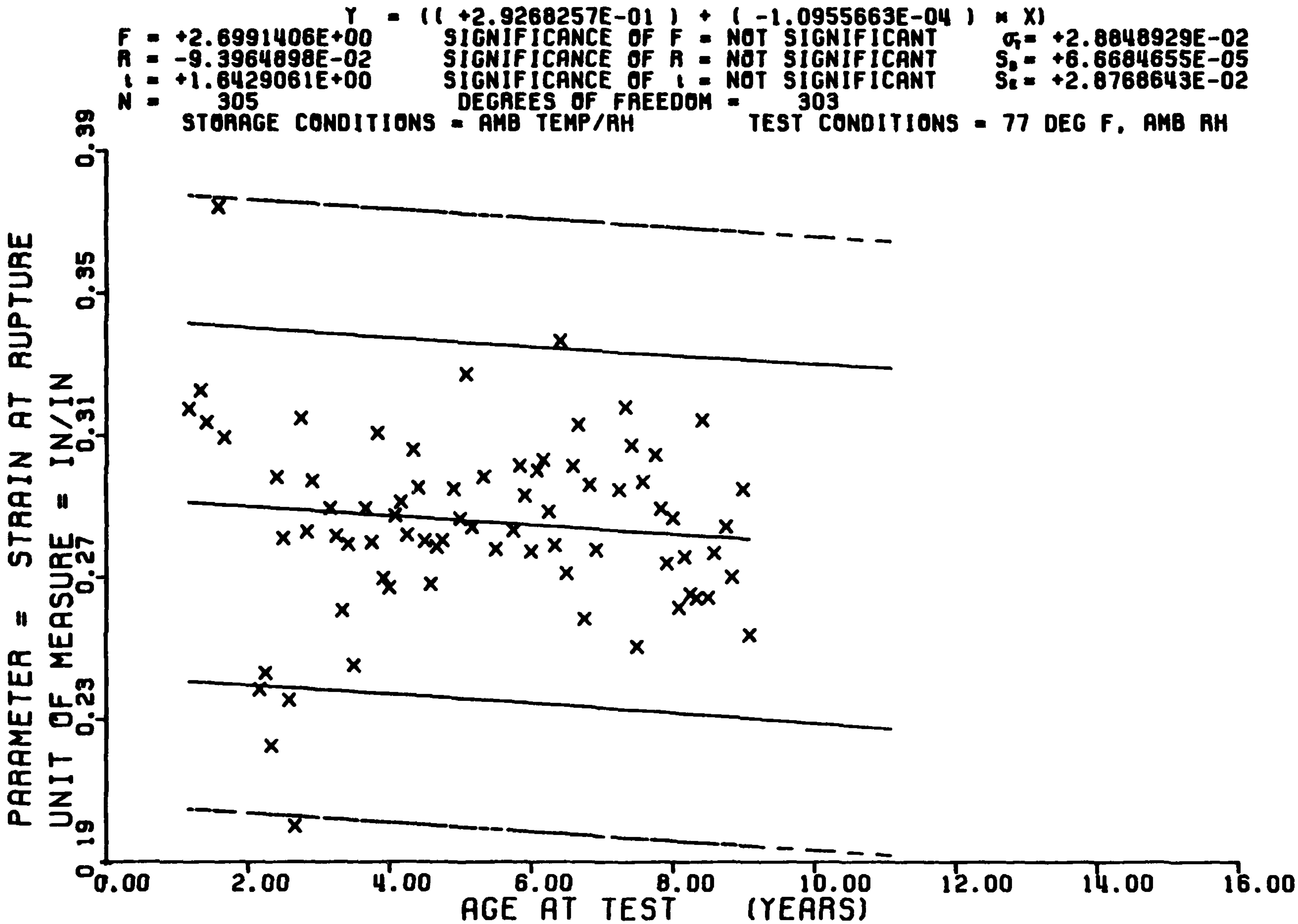
TENSILE TRIAXIAL MODULUS, ANB-3066 (ANB P-POLYMER UNLND), 1750 IN/MIN, 600 PSI

Figure 5-6



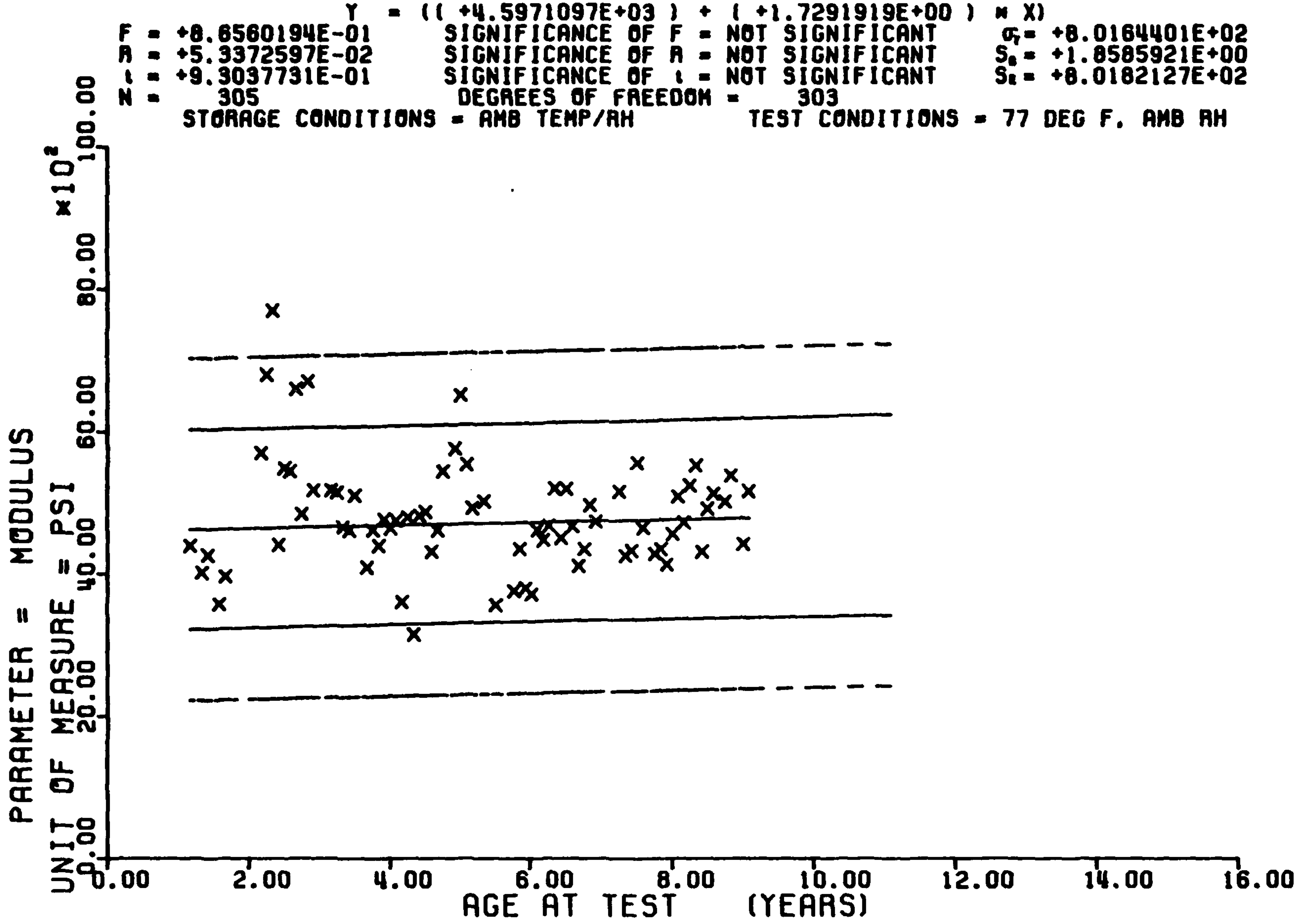
Y = ((+5.9941360E+02) + (+2.7464397E-01) * X)
F = +1.3981736E+01 SIGNIFICANCE OF F = SIGNIFICANT
R = +2.1002134E-01 SIGNIFICANCE OF R = SIGNIFICANT
t = +3.7392160E+00 SIGNIFICANCE OF t = SIGNIFICANT
N = 305 DEGREES OF FREEDOM = 303
σT = +3.2356639E+01
Sb = +7.3449614E-02
Se = +3.1687136E+01
STORAGE CONDITIONS = AMB TEMP/RH
TEST CONDITIONS = 77 DEG F, AMB RH
PARAMETER = MAXIMUM STRESS
UNIT OF MEASURE = PSI
750.00
700.00
650.00
600.00
550.00
500.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
AGE AT TEST (YEARS)
TENSILE TRIAXIAL MAX STRESS, ANB-3066 (ANT UNLINED), 1750 IN/MIN, 600 PSI

Figure 5-7



TENSILE TRIAXIAL STRAIN AT RUPTURE, ANB-3066 (ANT UNLND), 1750 IN/MIN, 600 PSI

Figure 5-8



TENSILE TRIAXIAL MODULUS, ANB-3066 (ANT UNLINED), 1750 IN/MIN, 600 PSI

Figure 5-9

Y = ((+5.9053027E+02) + (-2.7403839E-01) * X)

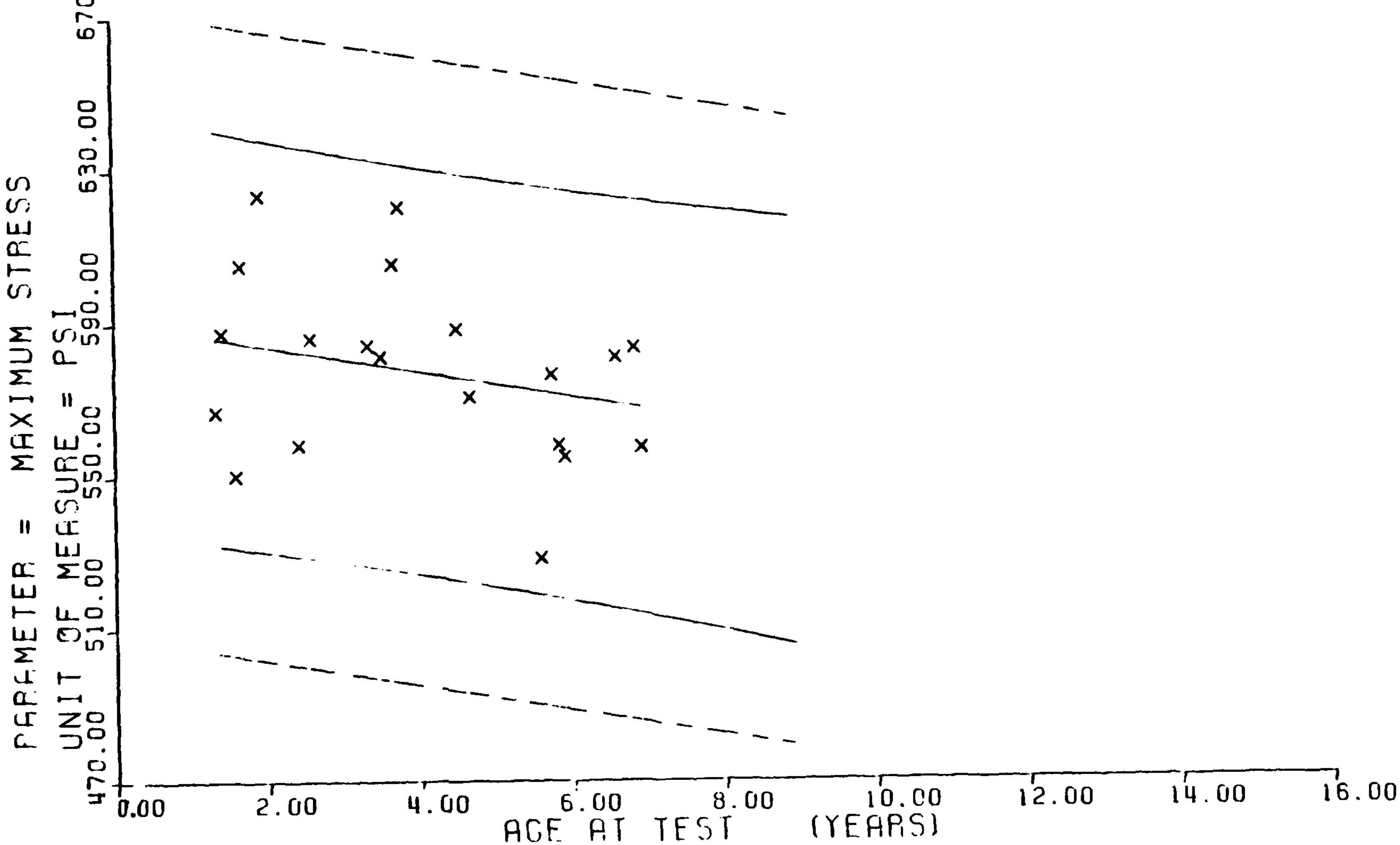
F = +2.9095907E+00 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_1 = +2.7935557E+01

R = -2.4144818E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT S_b = +1.6065544E-01

ι = +1.7057522E+00 SIGNIFICANCE OF ι = NOT SIGNIFICANT S_E = +2.7395924E+01

N = 49 DEGREES OF FREEDOM = 47

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F. AMB RH



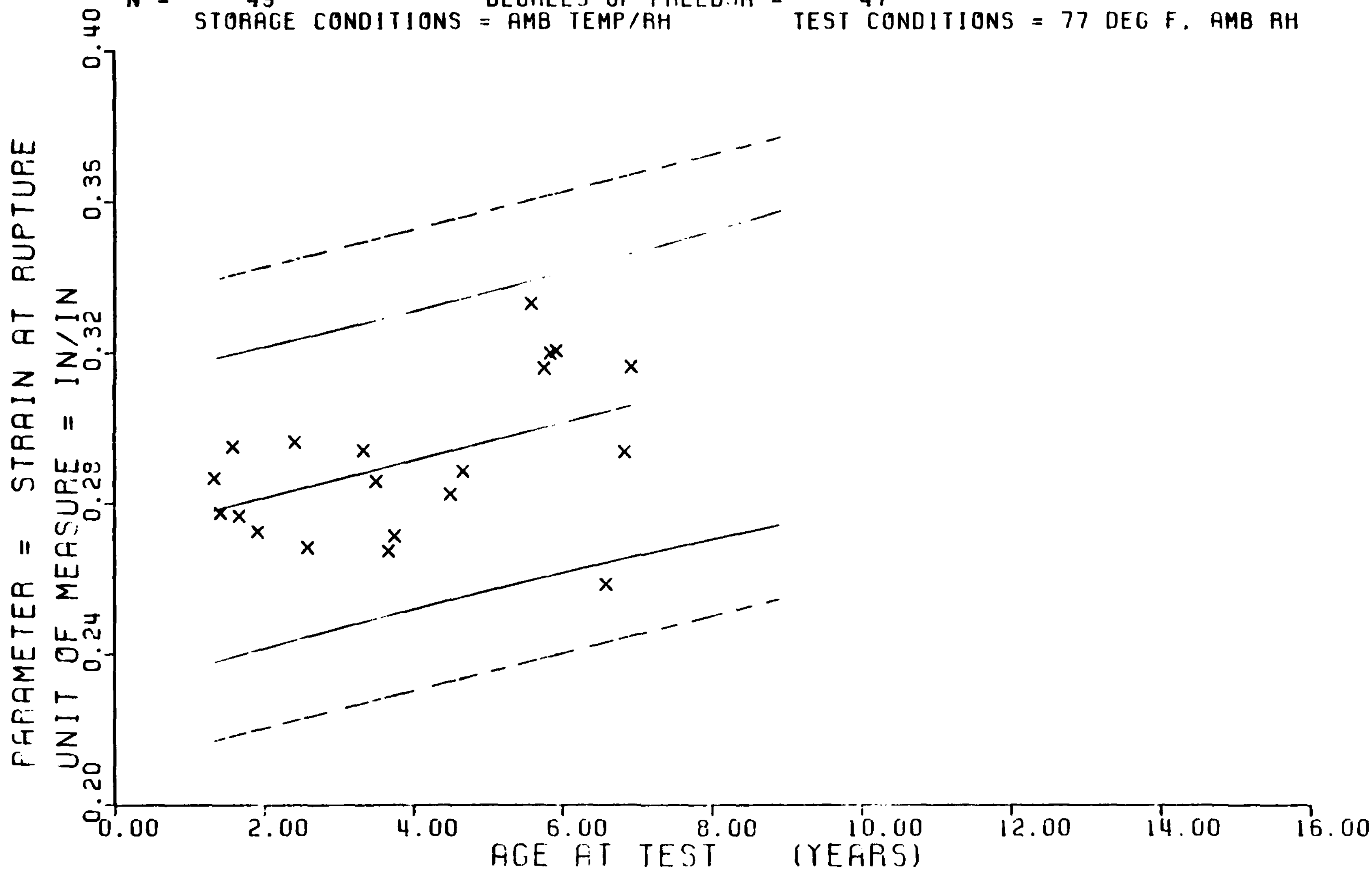
TENSILE TRIAX MAX STRESS, ANB-3066 (ANB G-POLYMER LINED). 1750 IN/MIN. 600 PSI

Figure 5-10

Y = ((+2.7160397E-01) + (+4.1474830E-04) * X)

F = +1.2017140E+01   SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +2.2622625E-02
R = +4.5124404E-01   SIGNIFICANCE OF R = SIGNIFICANT S_B = +1.1964210E-04
ι = +3.4665747E+00   SIGNIFICANCE OF ι = SIGNIFICANT S_E = +2.0402084E-02
N = 49   DEGREES OF FREEDOM = 47

STORAGE CONDITIONS = AMB TEMP/RH   TEST CONDITIONS = 77 DEG F, AMB RH



TENSILE TRIAX RUP STRAIN, ANB-3066 (ANB C-POLYMER LINED), .1750 IN/MIN, 600 PSI

Figure 5-11

Y = ((+4.2258737E+03) + (-5.3713993E+00) * X)

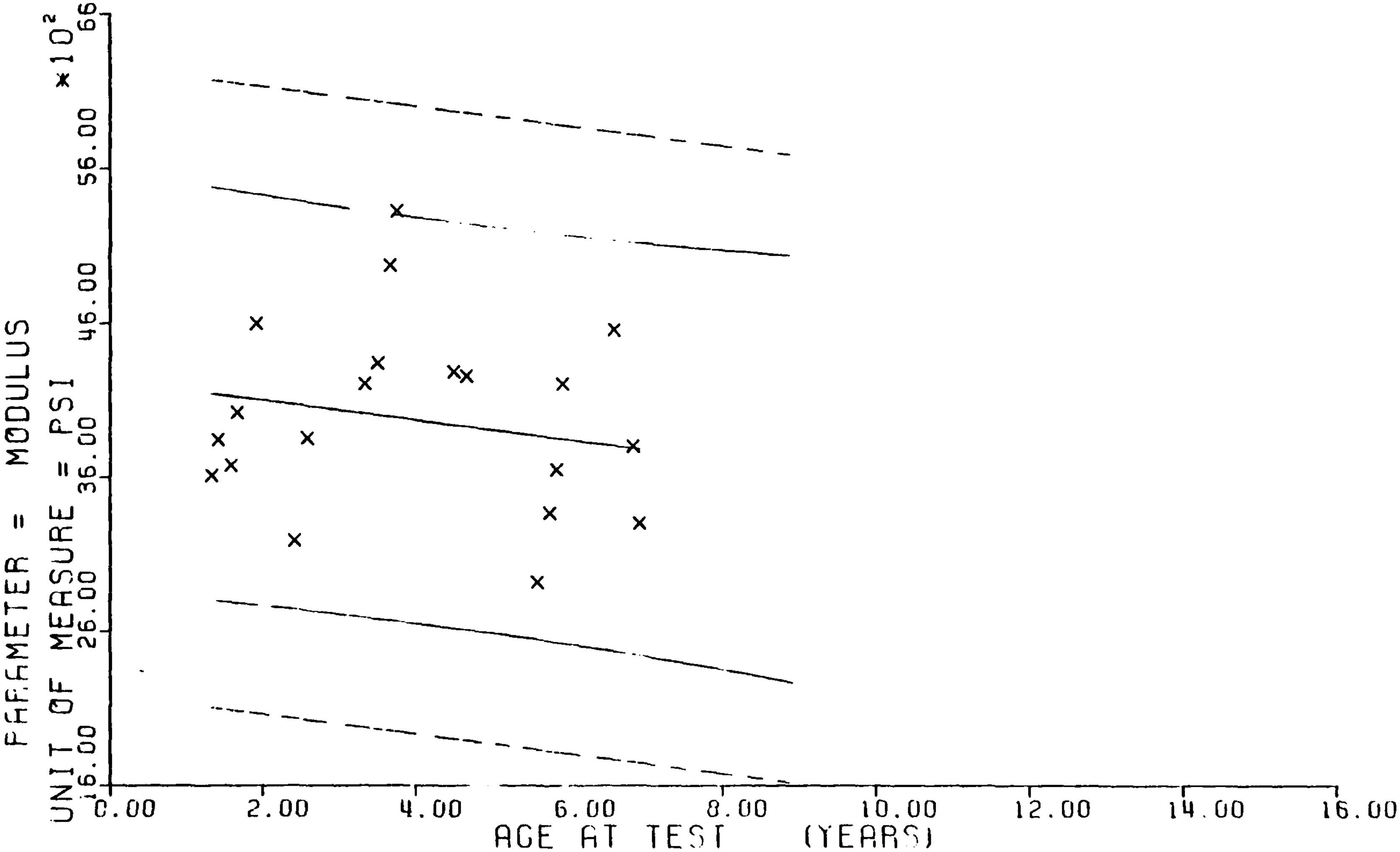
F = +1.8249644E+00 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_Y = +6.8383462E+02

R = -1.9333310E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT S_B = +3.9761269E+00

ι = +1.3509124E+00 SIGNIFICANCE OF ι = NOT SIGNIFICANT S_E = +6.7803285E+02

N = 49 DEGREES OF FREEDOM = 47

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F. AMB RH



TENSILE TRIAXIAL MODULUS, ANB-3066 (ANB G-POLYMER LINED), 1750 IN/MIN, 600 PSI

Figure 5-12

Y = ((+5.7637848E+02) + (+5.1109716E-01) * X)

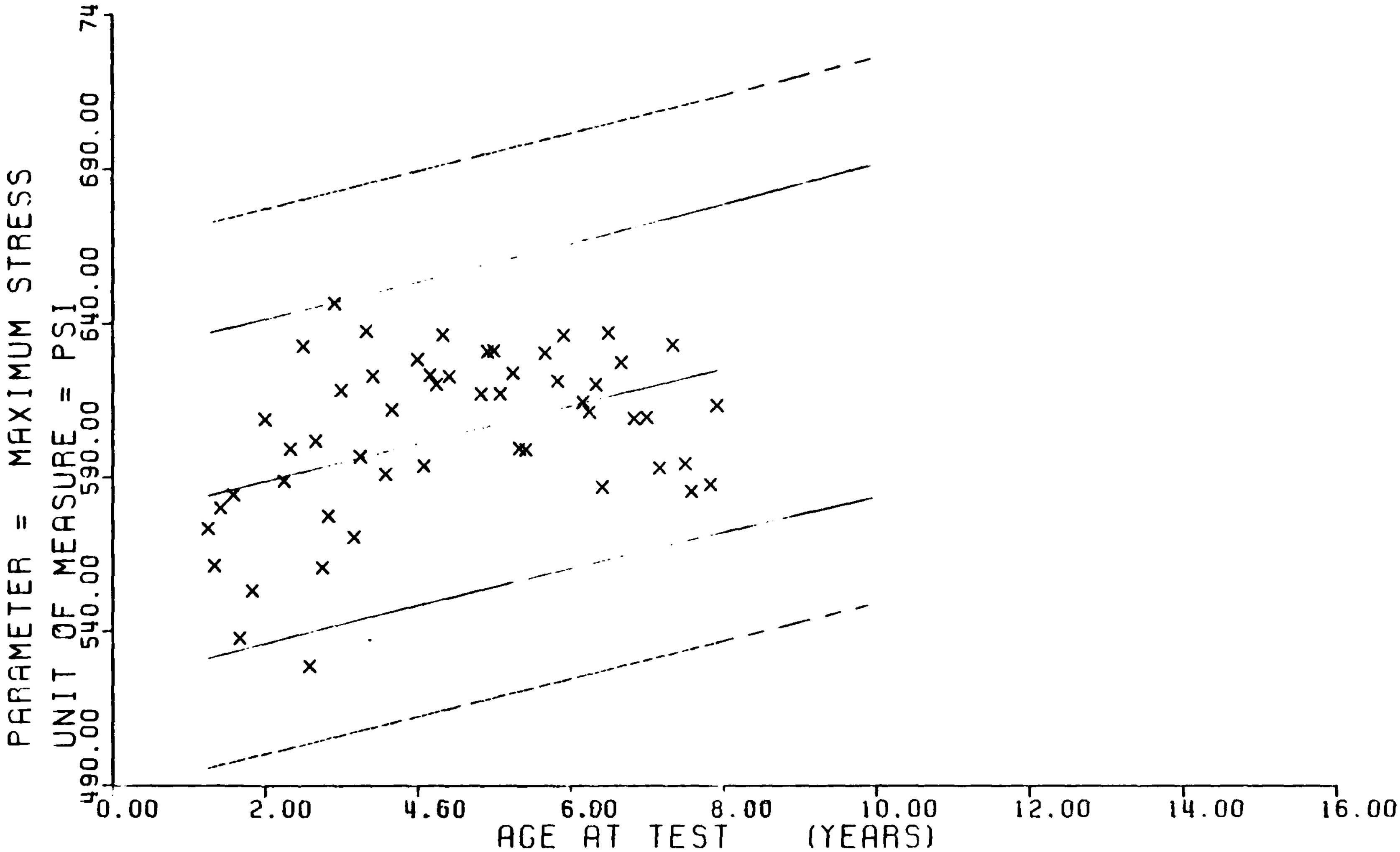
F = +2.6060095E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_T = +3.1621113E+01

R = +3.6740219E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +1.0011876E-01

ι = +5.1049089E+00 SIGNIFICANCE OF ι = SIGNIFICANT S_E = +2.9497522E+01

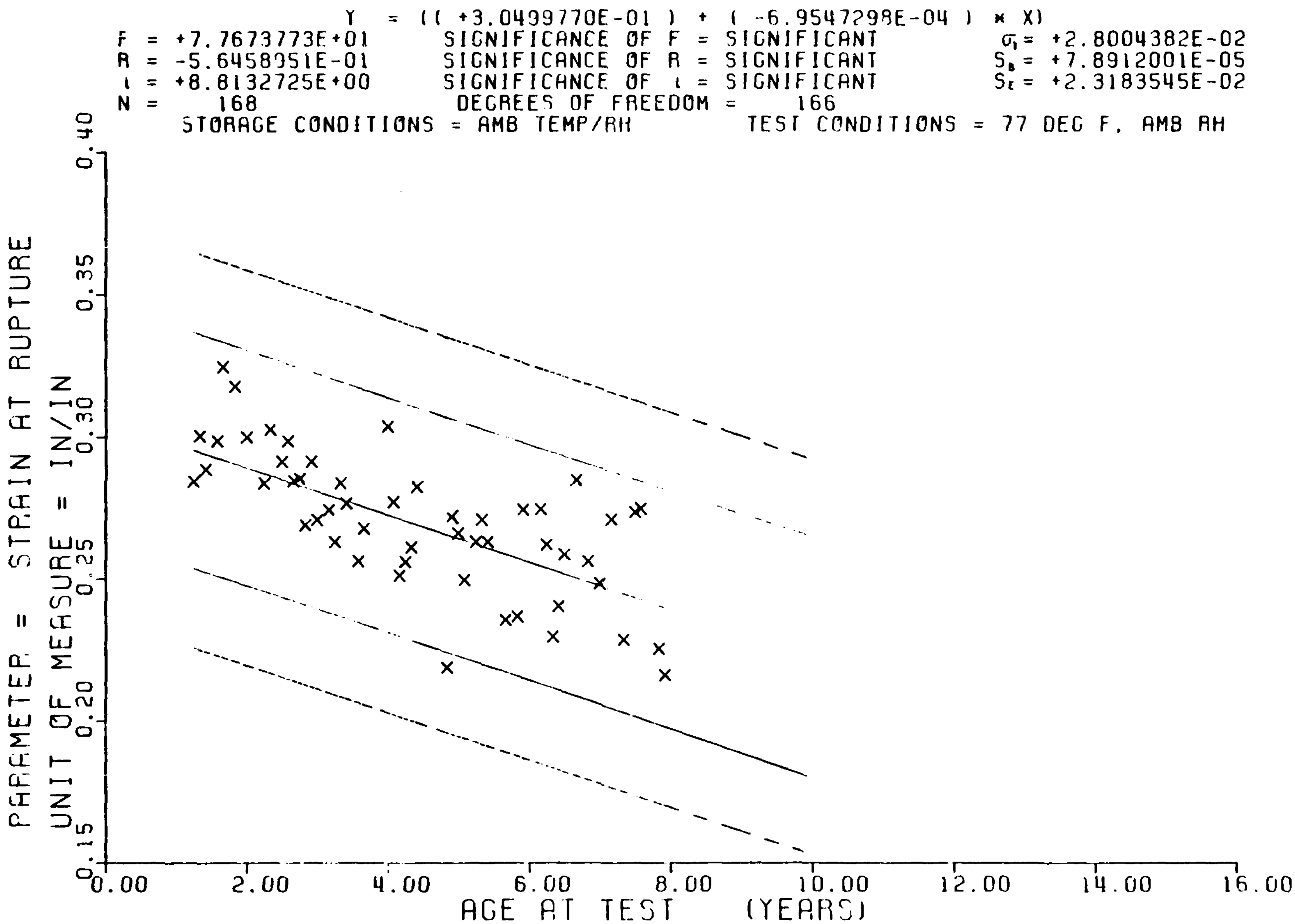
N = 169 DEGREES OF FREEDOM = 167

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F. AMB RH



TENSILE TRIAX MAX STRESS, ANB-3066 (ANT P-POLYMER LINED), 1750 IN/MIN, 600 PSI

Figure 5-13

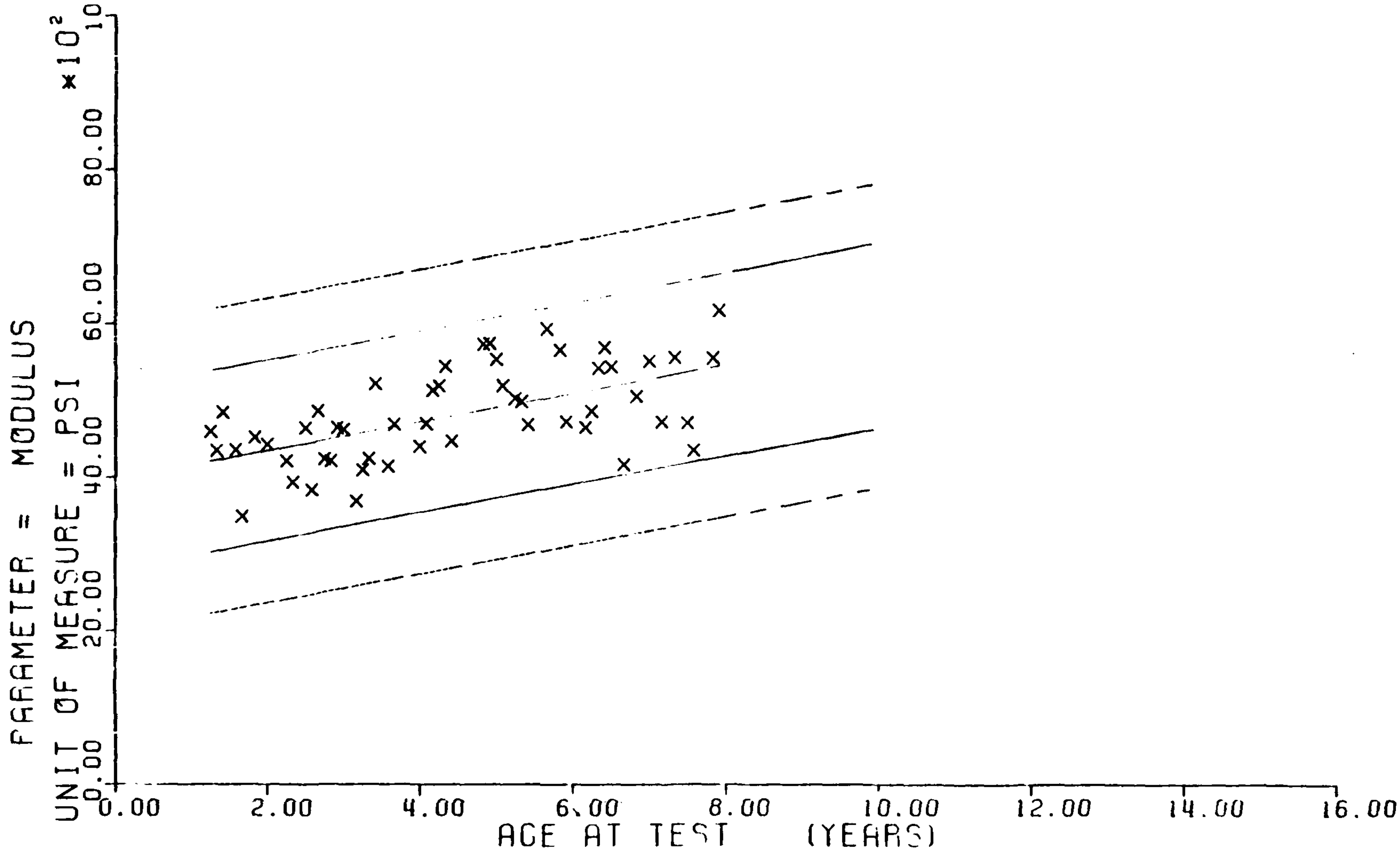


TENSILE TRIAX RUP STRAIN, ANB-3066 (ANT P-POLYMER LINED), 1750 IN/MIN, 600 PSI

Figure 5-14

Y = ((+3.9703663E+03) + (+1.5570627E+01) * X)

F = +4.8181609E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +7.4796878E+02
R = +4.7319274E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +2.2431869E+00
t = +6.9412973E+00 SIGNIFICANCE OF t = SIGNIFICANT S_E = +6.6089967E+02
N = 169 DEGREES OF FREEDOM = 167
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



TENSILE TRIAXIAL MODULUS, ANB-3066 (ANT P-POLYMER LINED), 1750 IN/MIN, 600 PSI

Figure 5-15

TABLE 5-4

ANALYSIS OF COVARIANCE COMPARISON OF REGRESSIONS
HIGH RATE HYDROSTATIC TENSILE (1750 in/min, 600 psi)

		Sm	Er	E
Lined Vs Unlined				
ANB P-polymer	Residual Variance	NS	S	S
	Slope	NS	NS	S
	Elevation	S	NS	S
ANB G-polymer	Residual Variance	S	NS	S
	Slope	S	NS	S
	Elevation	S	S	S
ANT P-polymer	Residual Variance	NS	S	NS
	Slope	NS	S	NS
	Elevation	S	NS	S
ANB P Unlined Vs ANT P Lined	Residual Variance	NS	S	S
	Slope	S	NS	NS
	Elevation	S	NS	S
G-polymer Vs P-polymer				
ANB Lined	Residual Variance	NS	NS	S
	Slope	S	NS	S
	Elevation	S	NS	S
ANB Unlined	Residual Variance	S	S	S
	Slope	NS	S	S
	Elevation	S	S	S
ANB G Unlined Vs ANT P Unlined	Residual Variance	S	S	NS
	Slope	S	NS	S
	Elevation	S	S	S
ANB G Lined Vs ANT P Lined	Residual Variance	NS	NS	S
	Slope	S	NS	NS
	Elevation	S	NS	S
ANB P-polymer Vs ANT P-polymer				
Lined	Residual Variance	S	NS	NS
	Slope	S	NS	S
	Elevation	NS	NS	S
Unlined	Residual Variance	S	NS	S
	Slope	S	S	NS
	Elevation	S	NS	S

Y = ((+4.3720926E+02) + (+5.6622349E-01) * X)

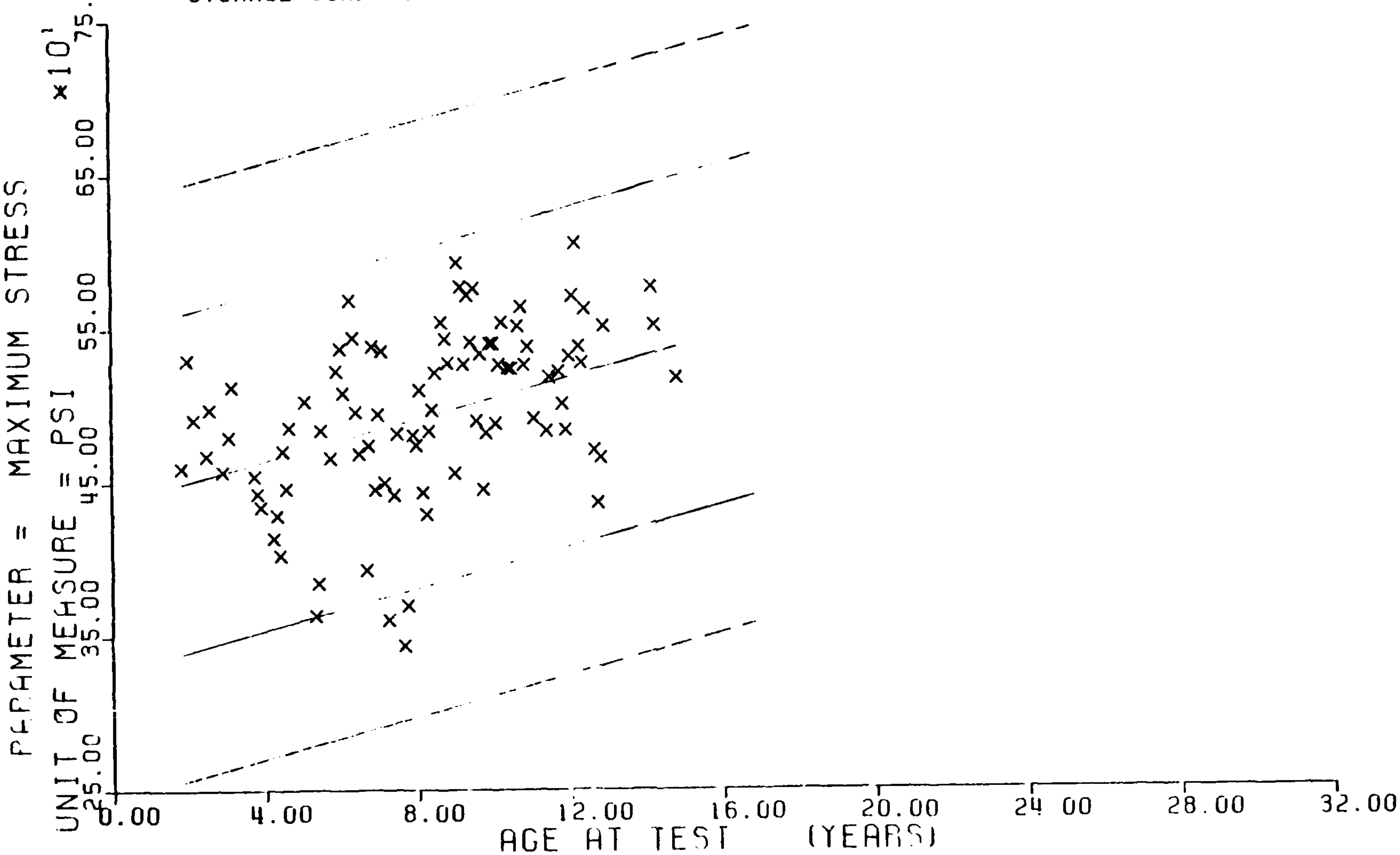
F = +7.5185141E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_1 = +6.7929833E+01

R = +3.1043249E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +6.5301307E-02

t = +8.6709365E+00 SIGNIFICANCE OF t = SIGNIFICANT S_E = +6.4619569E+01

N = 707 DEGREES OF FREEDOM = 705

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



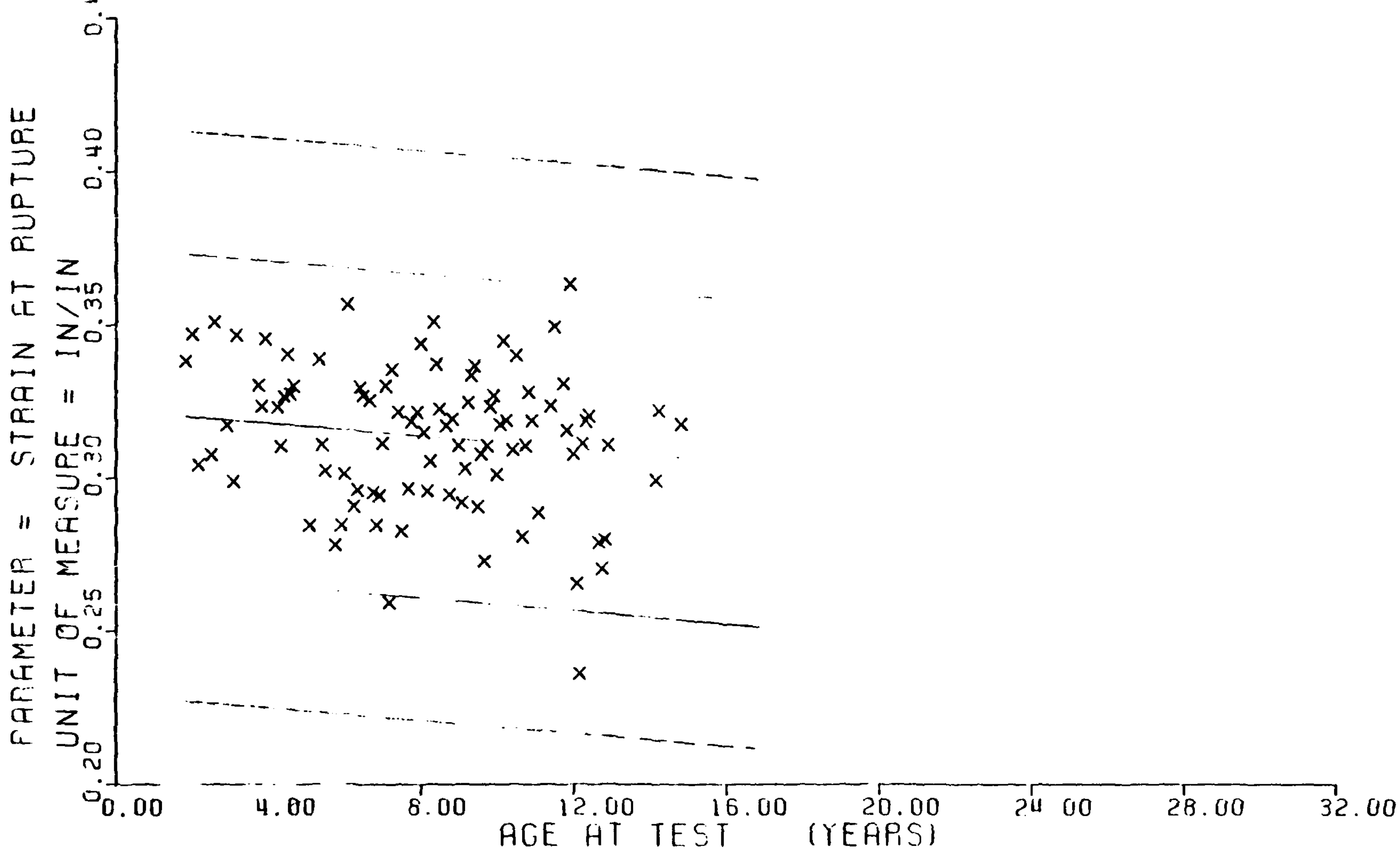
TENSILE MAXIMUM STRESS, ANB-3066 (ANB G-POL) UNLND), 1750 IN/MIN, 600 PSI

Figure 5-16

Y = ((+3.2207197E-01) + (-8.6618203E-05) × X)

F = +7.6603376E+00	SIGNIFICANCE OF F = SIGNIFICANT	σ_Y = +3.1114752E-02
R = -1.0357705E-01	SIGNIFICANCE OF R = SIGNIFICANT	S_β = +3.1295739E-05
t = +2.7677314E+00	SIGNIFICANCE OF t = SIGNIFICANT	S_ϵ = +3.0969015E-02
N = 707	DEGREES OF FREEDOM = 705	

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



TENSILE RUPTURE STRAIN, ANB-3066 (ANB G-POLY UNLND), 1750 IN/MIN, 600 PSI

Figure 5-17

Y = ((+2.5432176E+03) + (+1.2079438E+01) * X)

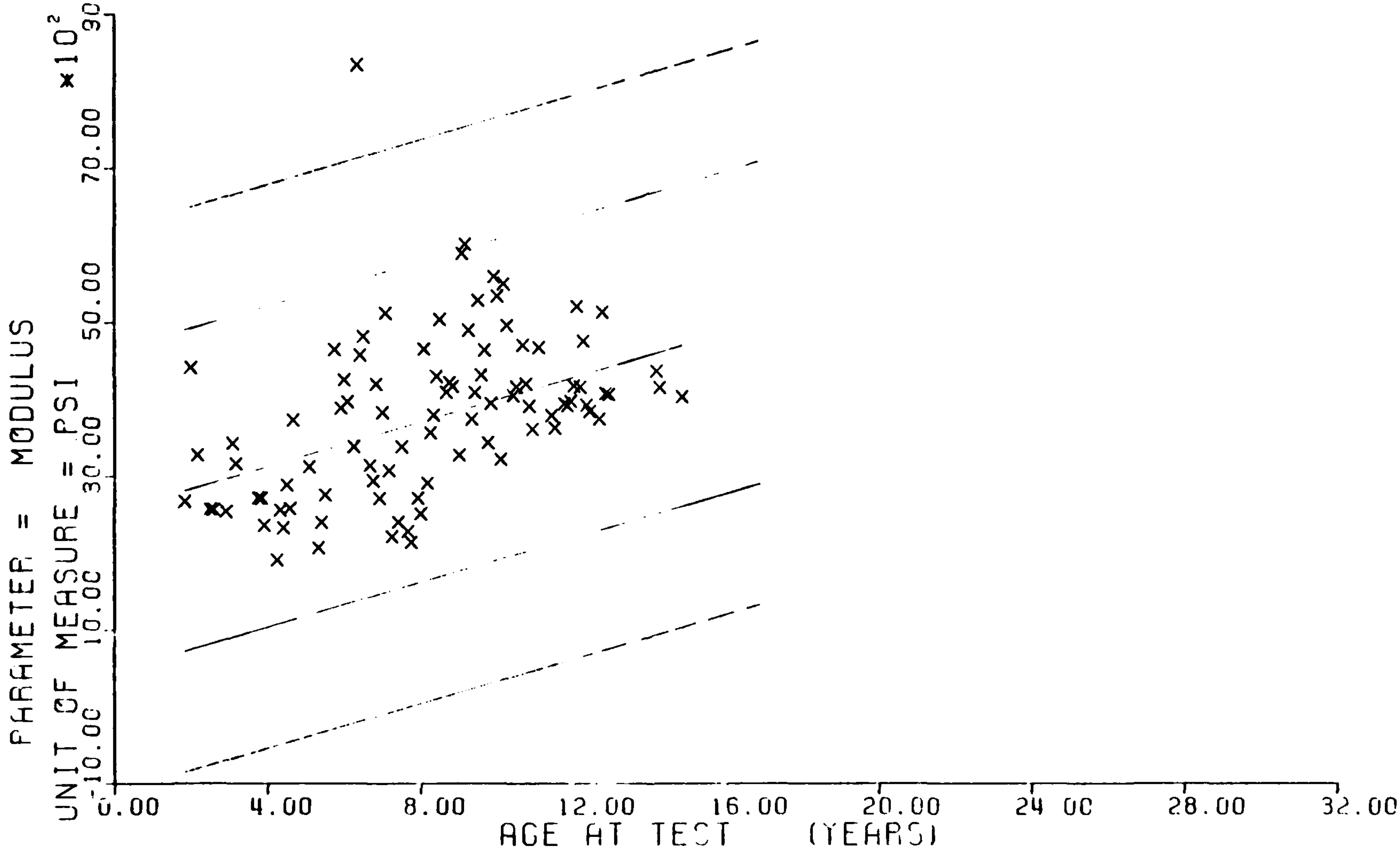
F = +9.5717664E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_T = +1.3011586E+03

R = +3.4574534E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +1.2346694E+00

ι = +9.7835404E+00 SIGNIFICANCE OF ι = SIGNIFICANT S_E = +1.2217796E+03

N = 707 DEGREES OF FREEDOM = 705

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F. AMB RH

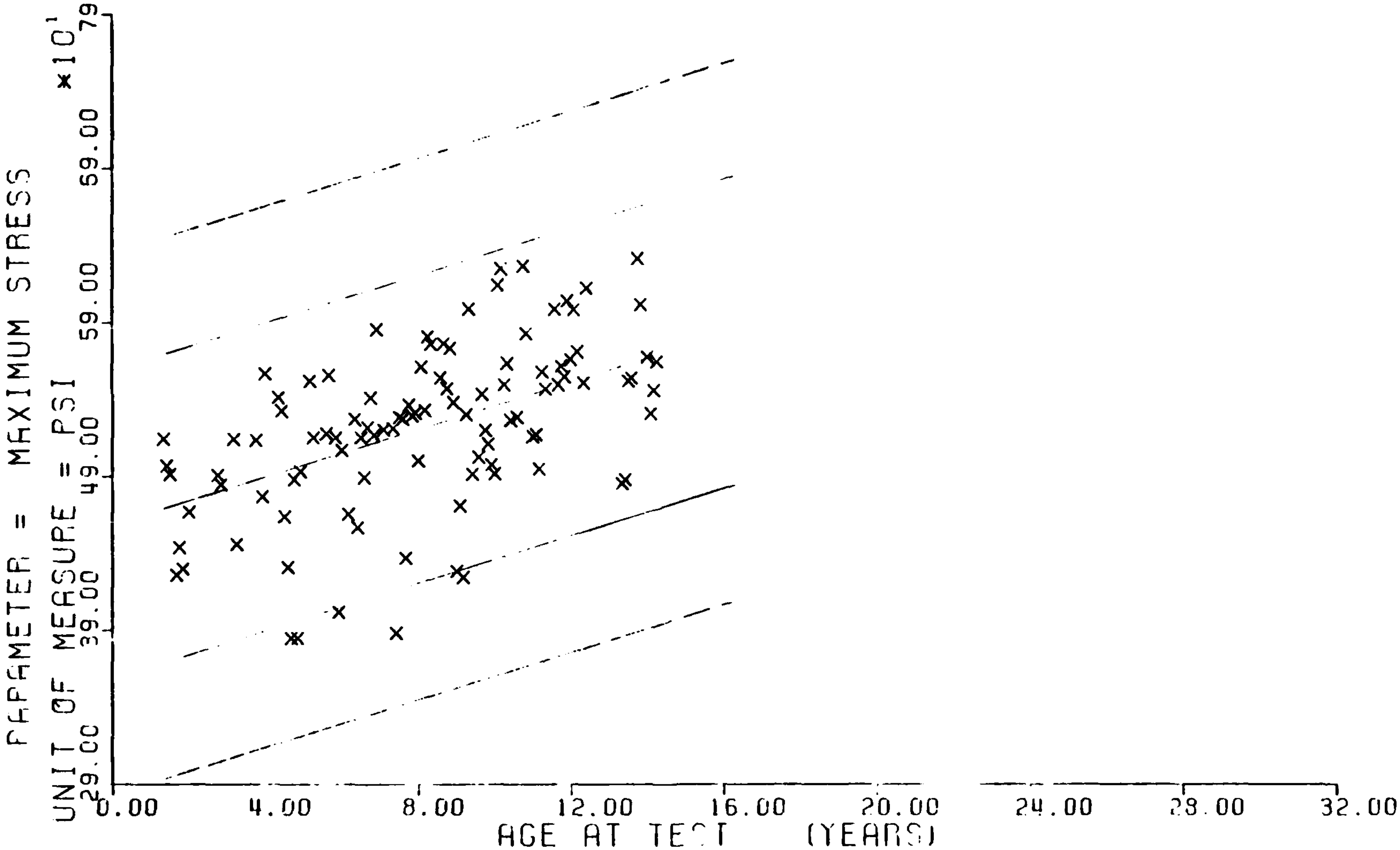


TENSILE MODULUS. ANB-3066 (ANB G-POLY UNLND). 1750 IN/MIN. 600 PSI

Figure 5-18

Y = ((+4.5900008E+02) + (+6.4478352E-01) * X)

F = +1.4136794E+02 SIGNIFICANCE OF F = SIGNIFICANT σ_1 = +6.4210676E+01
R = +4.0796935E-01 SIGNIFICANCE OF R = SIGNIFICANT S_s = +5.4229856E-02
ι = +1.1889825E+01 SIGNIFICANCE OF ι = SIGNIFICANT S_t = +5.8665452E+01
N = 710 DEGREES OF FREEDOM = 708
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F. AMB RH



TENSILE MAXIMUM STRESS. ANB-3066 (ANB P-POLY UNLND). 1750 IN/MIN. 600 PSI

Figure 5-19

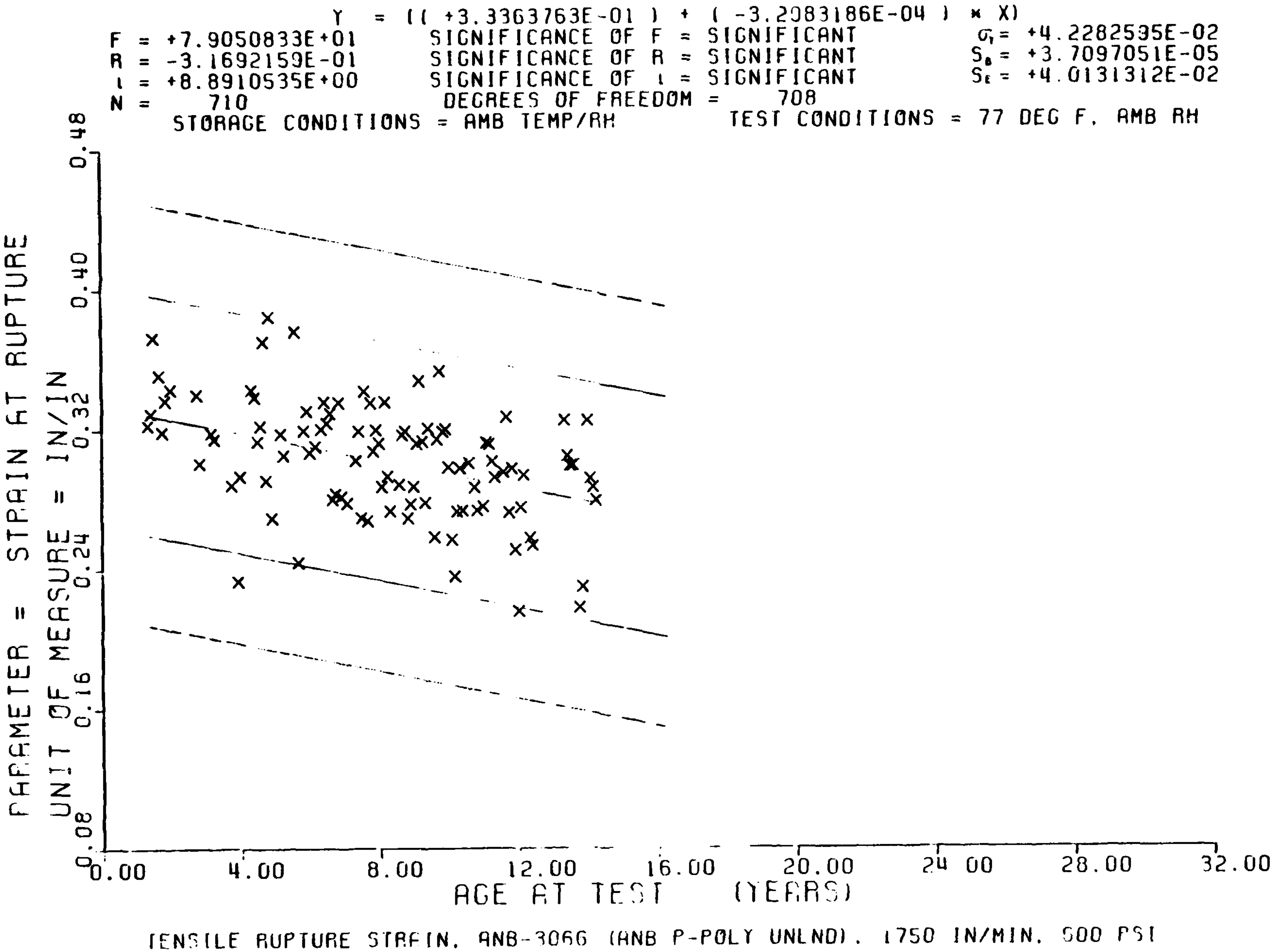

Y = ((+3.3363763E-01) + (-3.2083186E-04) * X)
F = +7.9050833E+01 SIGNIFICANCE OF F = SIGNIFICANT
R = -3.1692159E-01 SIGNIFICANCE OF R = SIGNIFICANT
ι = +8.8910535E+00 SIGNIFICANCE OF ι = SIGNIFICANT
N = 710 DEGREES OF FREEDOM = 708
σ = +4.2282595E-02
S = +3.7097051E-05
S = +4.0131312E-02
STORAGE CONDITIONS = AMB TEMP/RH
TEST CONDITIONS = 77 DEG F, AMB RH
PARAMETER = STRAIN AT RUPTURE
UNIT OF MEASURE = IN/IN
0.48
0.40
0.32
0.24
0.16
0.08
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
TENSILE RUPTURE STRAIN, ANB-3066 (ANB P-POLY UNLND), 1750 IN/MIN, 500 PSI

Figure 5-20

Y = ((+2.3171781E+03) + (+1.9120468E+01) * X)

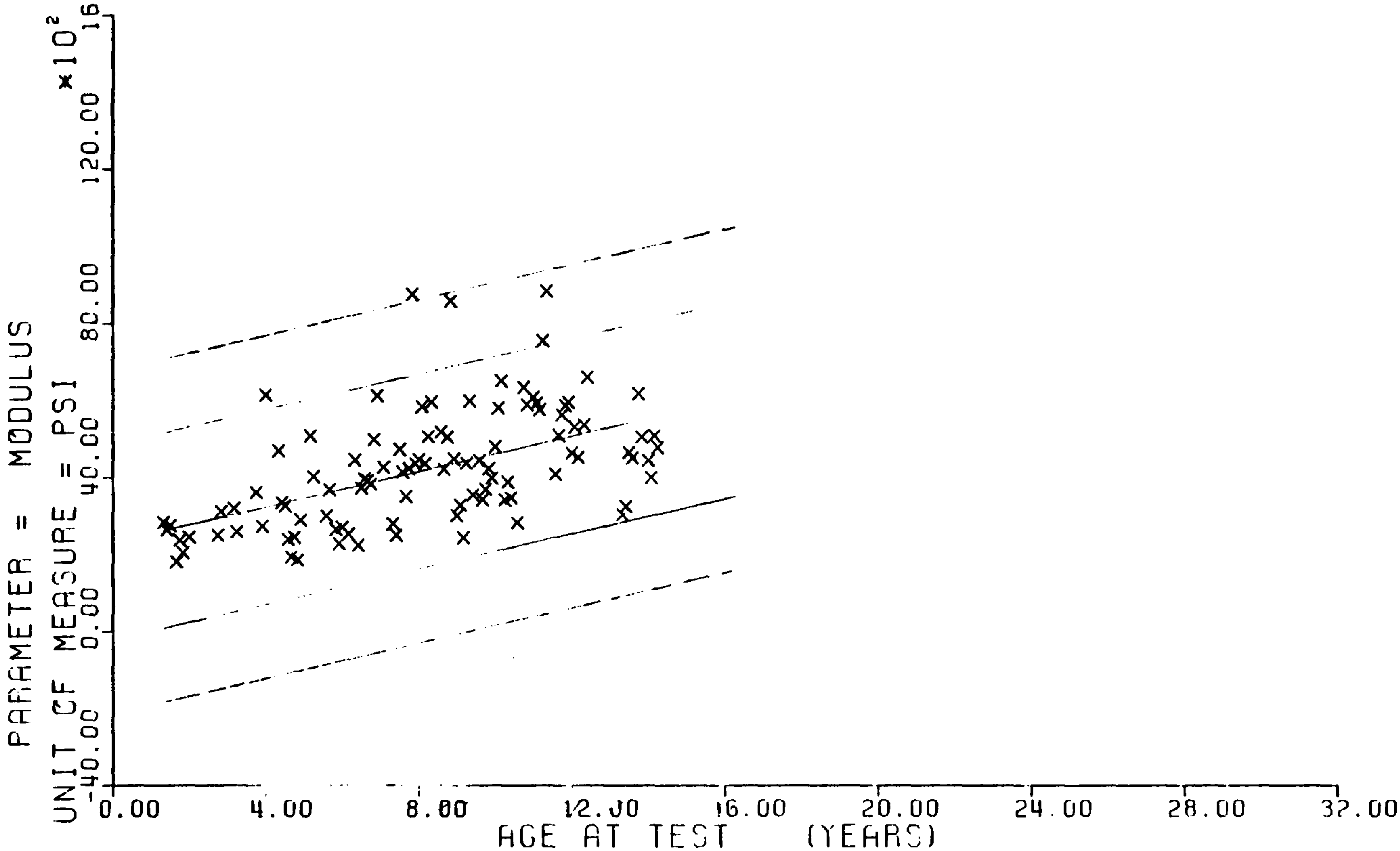
F = +1.9360158E+02 SIGNIFICANCE OF F = SIGNIFICANT σ_T = +1.6763791E+03

R = +4.6339049E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +1.3741814E+00

t = +1.3914078E+01 SIGNIFICANCE OF t = SIGNIFICANT S_E = +1.4865791E+03

N = 710 DEGREES OF FREEDOM = 708

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



TENSILE MODULUS, ANB-3066 (ANB P-POLY UNLND), 1750 IN/MIN, 600 PSI

Figure 5-21

Y = ((+4.3879816E+02) + (+1.3600854E+00) * X)

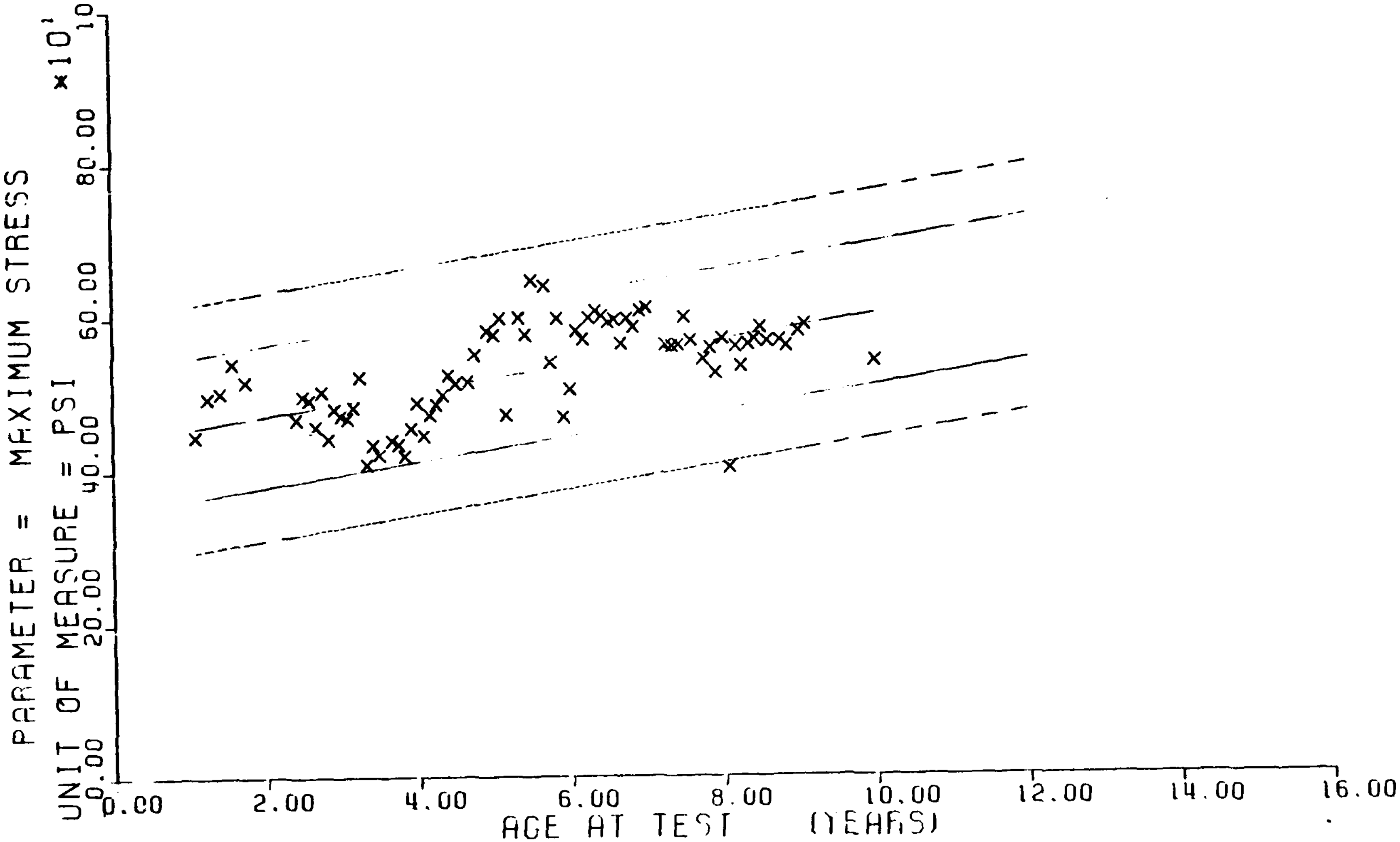
F = +2.1252953E+02 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +6.4695156E+01

R = +5.5639092E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +9.3294605E-02

t = +1.4578392E+01 SIGNIFICANCE OF t = SIGNIFICANT S_E = +5.3813217E+01

N = 476 DEGREES OF FREEDOM = 474

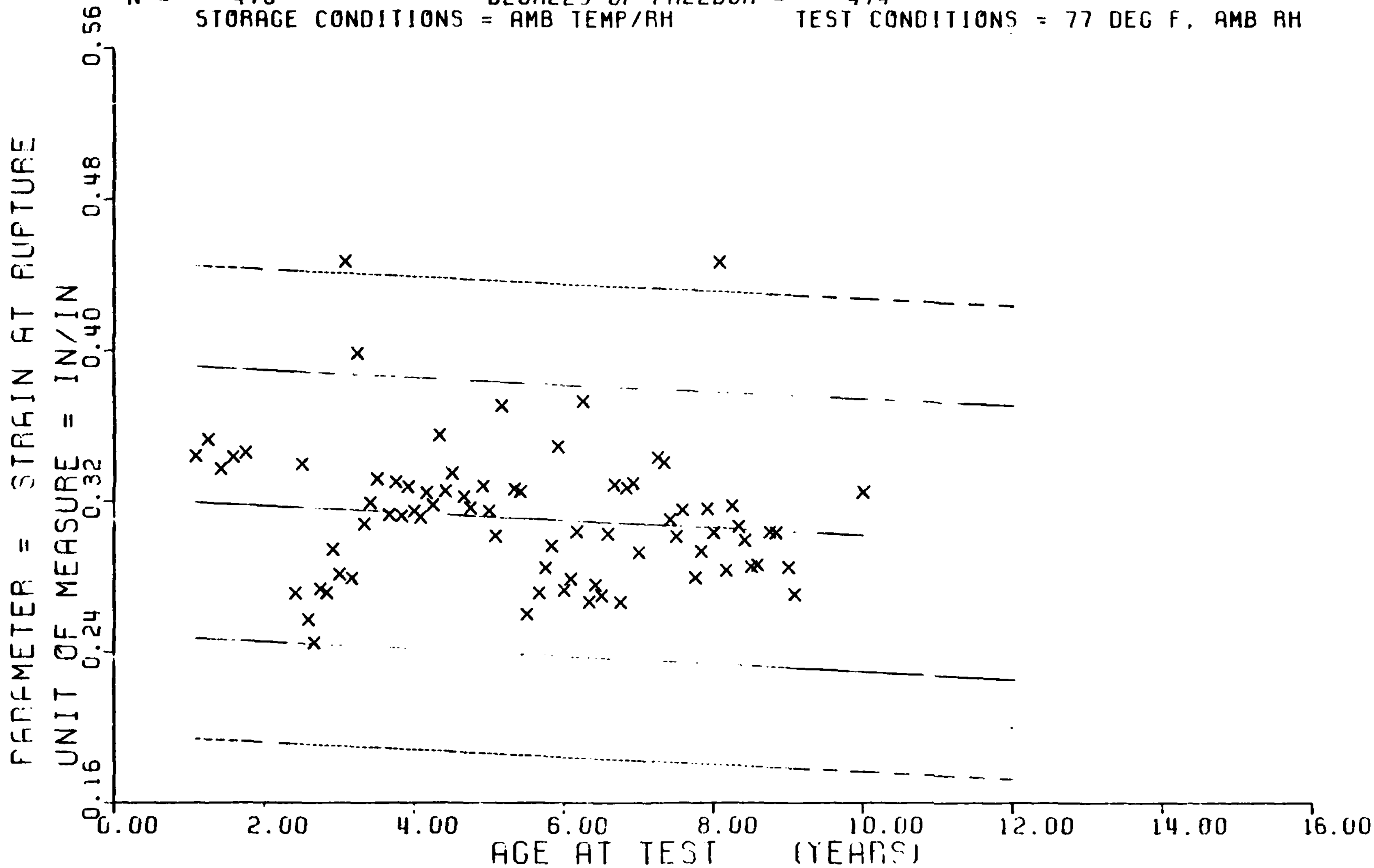
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



TENSILE MAXIMUM STRESS, ANB-3066 (ANT UNLND), 1750 IN/MIN, 600 PSI

Figure 5-22

Y = ((+3.2161268E-01) + (-1.6298741E-04) * X)
F = +5.0421542E+00 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_1 = +4.2045401E-02
R = -1.0259381E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = + .2584854E-05
t = +2.2454741E+00 SIGNIFICANCE OF t = SIGNIFICANT S_E = .1867635E-02
N = 476 DEGREES OF FREEDOM = 474
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH

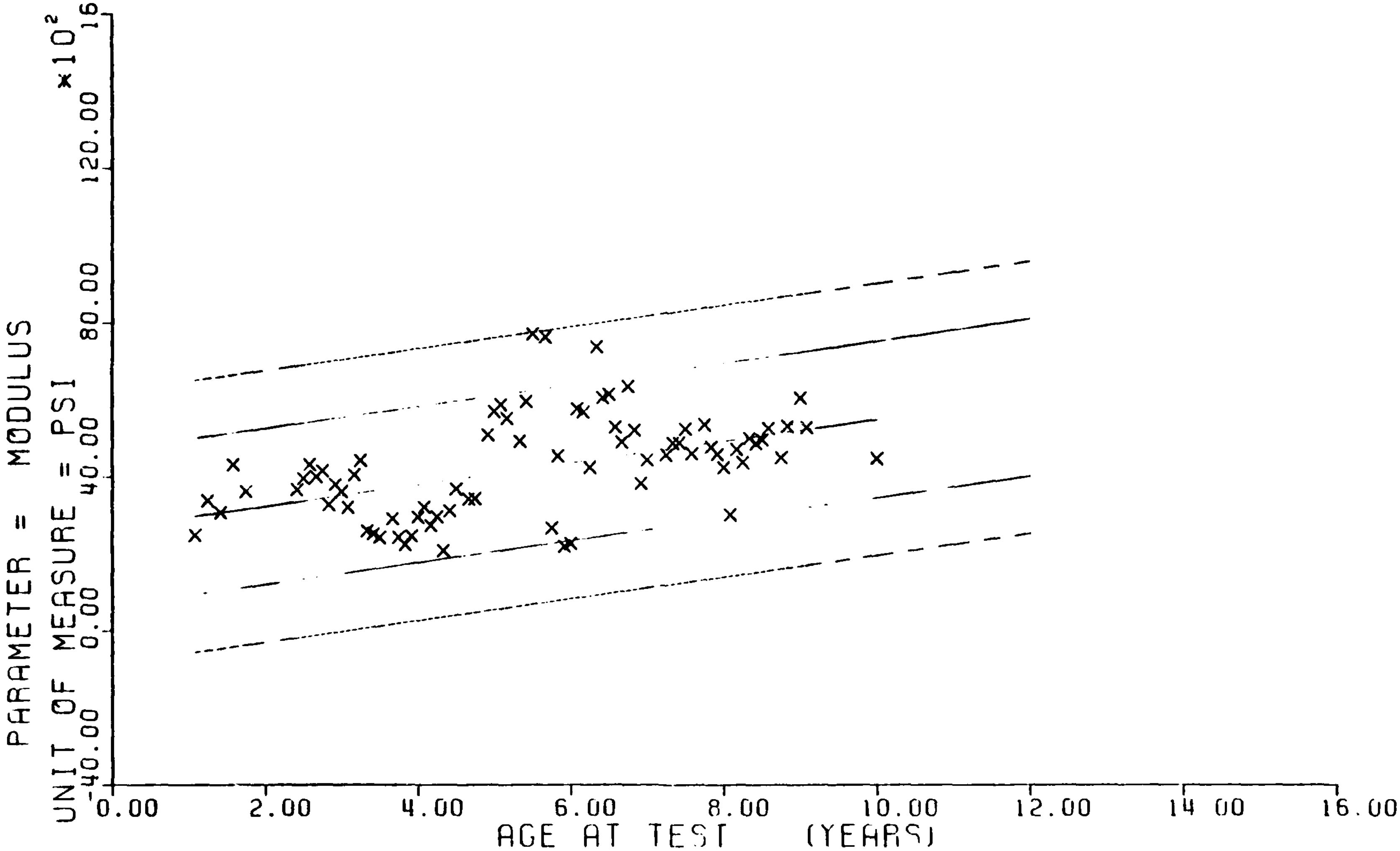


TENSILE RUPTURE STRAIN, ANB-3066 (ANT UNLND), 1750 IN/MIN, 600 PSI

Figure 5-23

Y = ((+2.6706084E+03) + (+2.3446331E+01) × X)

F = +1.3182560E+02 SIGNIFICANCE OF F = SIGNIFICANT σ_T = +1.3302536E+03
R = +4.6647252E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +2.0420906E+00
ι = +1.1481533E+01 SIGNIFICANCE OF ι = SIGNIFICANT S_E = +1.1778973E+03
N = 476 DEGREES OF FREEDOM = 474
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F. AMB RH



TENSILE MODULUS. ANB-3066 (ANT UNLND). 1750 IN/MIN. 500 PSI

Figure 5-24

Y = ((+3.5579730E+02) + (+2.8381631E+00) * X)

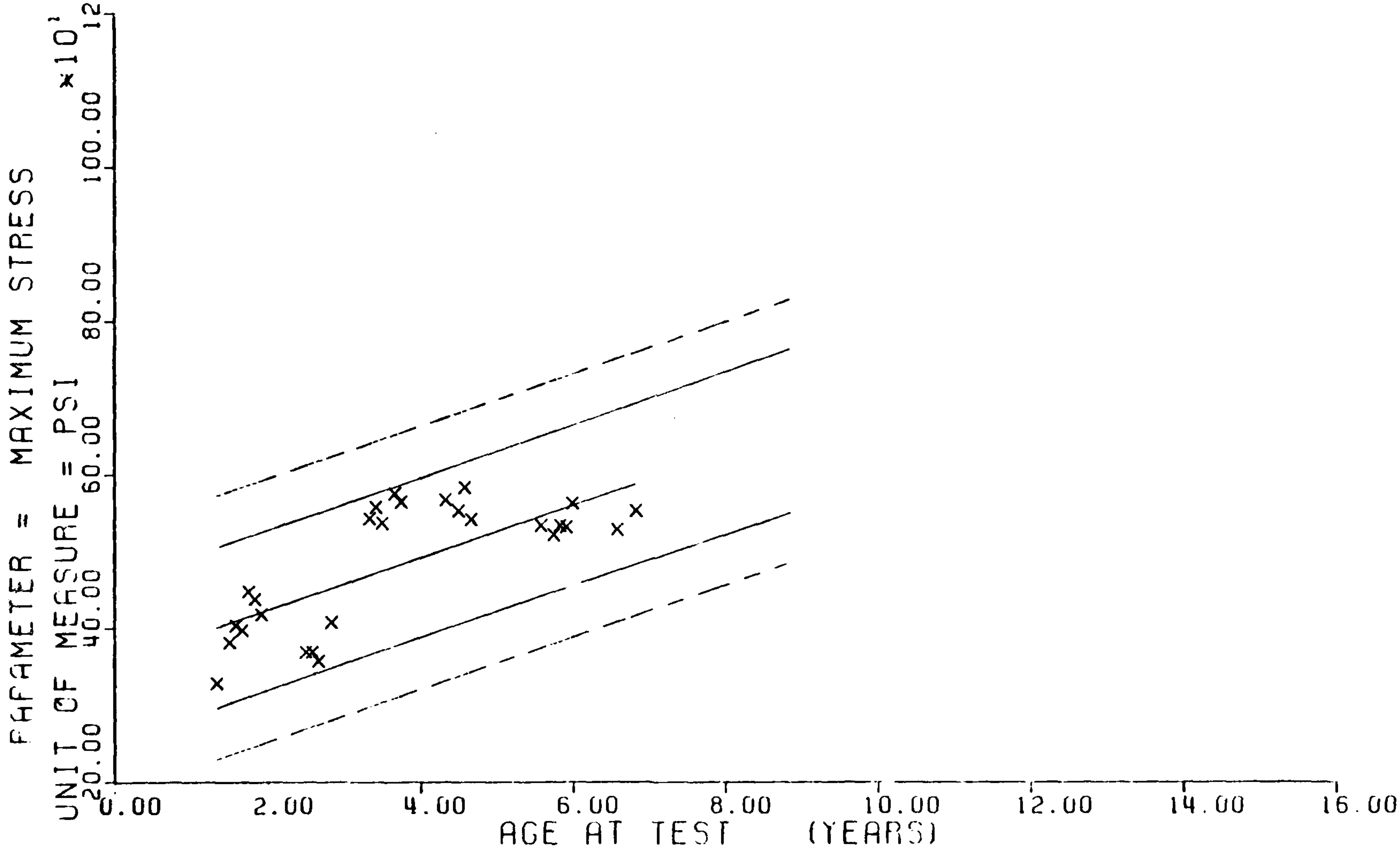
F = +1.3924835E+02 SIGNIFICANCE OF F = SIGNIFICANT σ_T = +8.4942451E+01

R = +7.4151803E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +2.4051508E-01

t = +1.1800354E+01 SIGNIFICANCE OF t = SIGNIFICANT S_E = +5.7172714E+01

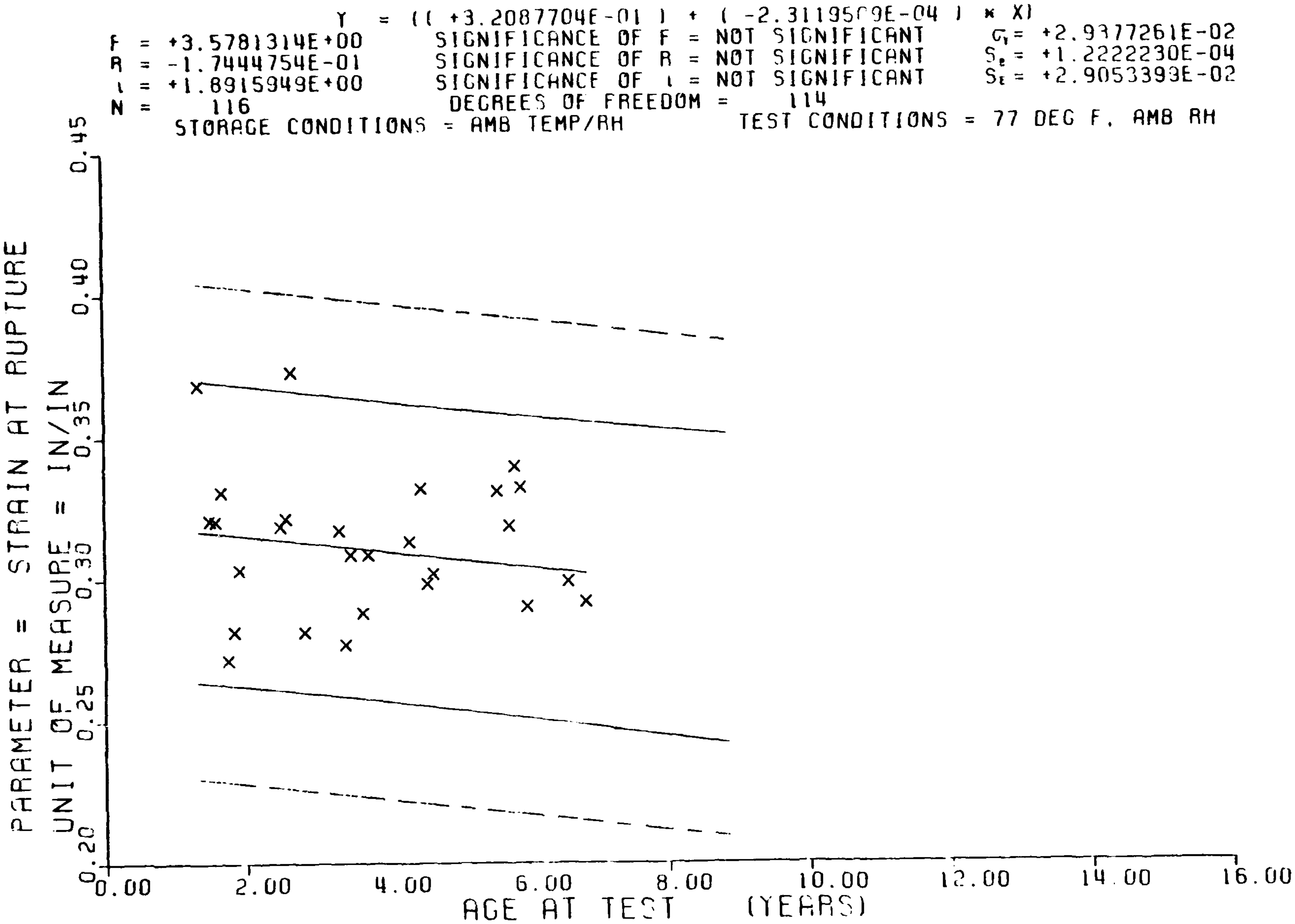
N = 116 DEGREES OF FREEDOM = 114

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F. AMB RH



TENSILE MAXIMUM STRESS. ANB-3066 (ANB G-POLY LINED). 1730 IN/MIN. 600 PSI

Figure 5-25

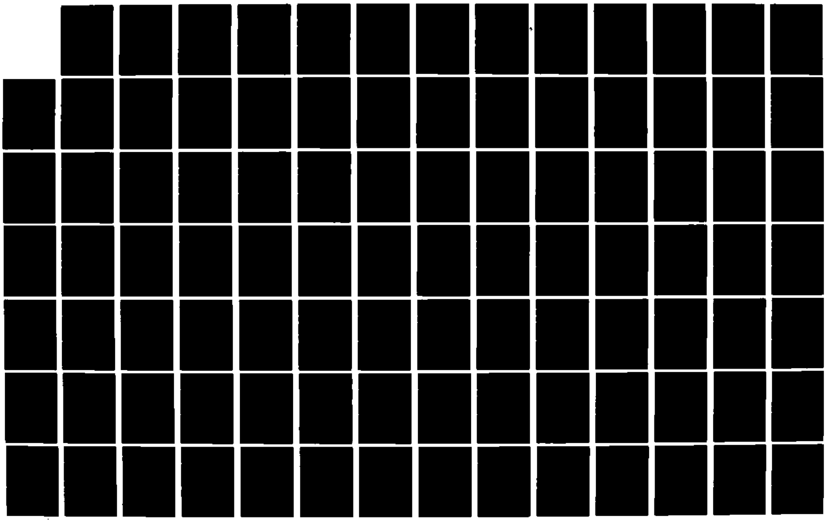


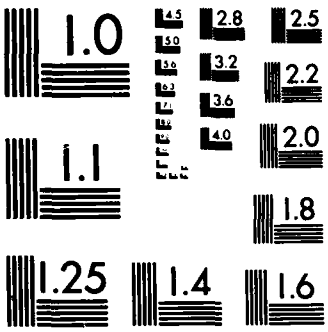
TENSILE RUPTURE STRAIN, ANB-3066 (ANB C-POLY LINED), 1750 IN/MIN, 600 PSI

Figure 5-26

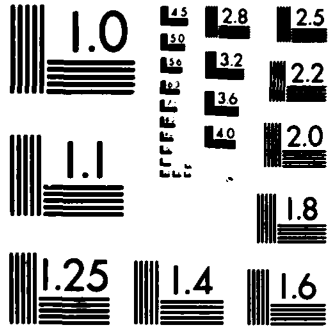
AD-A120 429 PROPELLANT SURVEILLANCE REPORT ANB-3066 PROPELLANT(U) 2/3
OGDEN AIR LOGISTICS CENTER HILL AFB UT PROPELLANT
ANALYSIS LAB E M DALABA AUG 82 MANPA-473(82)

UNCLASSIFIED F/G 21/9.2 NL

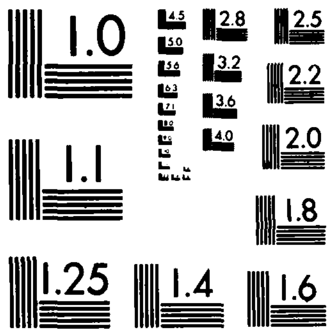




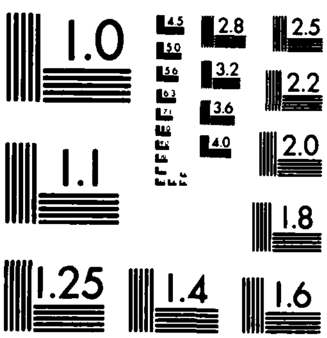
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



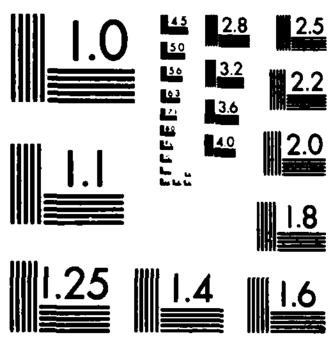
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Y = ((+2.2748100E+03) + (+2.6739883E+01) * X)

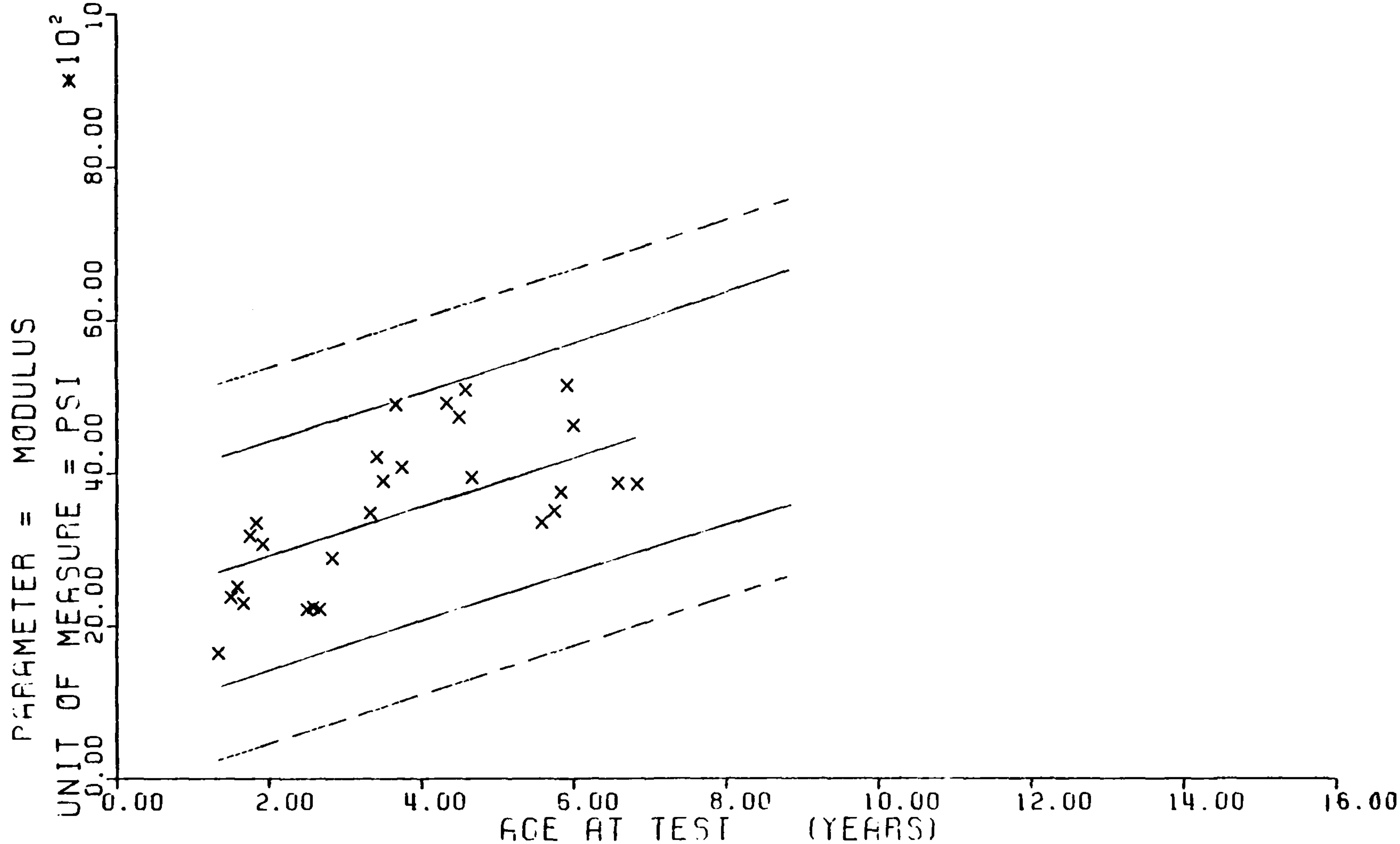
F = +5.9991043E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +1.0094325E+03

R = +5.8719150E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +3.4523617E+00

ι = +7.7453884E+00 SIGNIFICANCE OF ι = SIGNIFICANT S_E = +8.2065909E+02

N = 116 DEGREES OF FREEDOM = 114

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



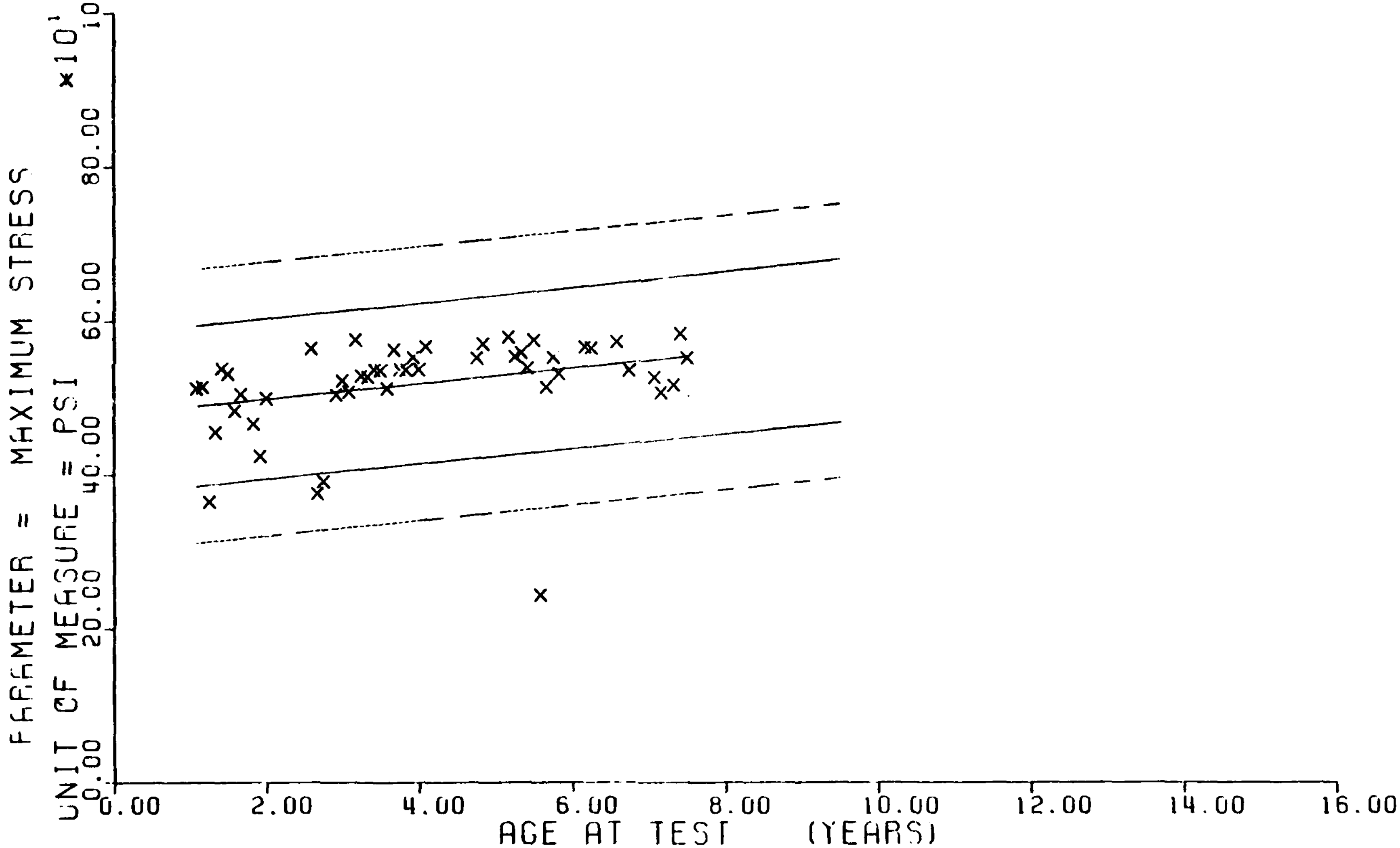
TENSILE MODULUS, ANB-3066 (ANB G-POLY LINED), 1750 IN/MIN, 600 PSI

Figure 5-27

Y = ((+4.7890404E+02) + (+8.3213811E-01) * X)

F = +2.5142275E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +6.2255821E+01
R = +3.0507457E-01 SIGNIFICANCE OF R = SIGNIFICANT S_b = +1.6595606E-01
t = +5.0142073E+00 SIGNIFICANCE OF t = SIGNIFICANT S_E = +5.9408863E+01
N = 247 DEGREES OF FREEDOM = 245

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



TENSILE MAXIMUM STRESS, ANB-3066 (ANB P-POLY LINED), 1750 IN/MIN, 600 PSI

Figure 5-28

Y = ((+3.3808040E-01) + (-4.7267115E-04) × X)

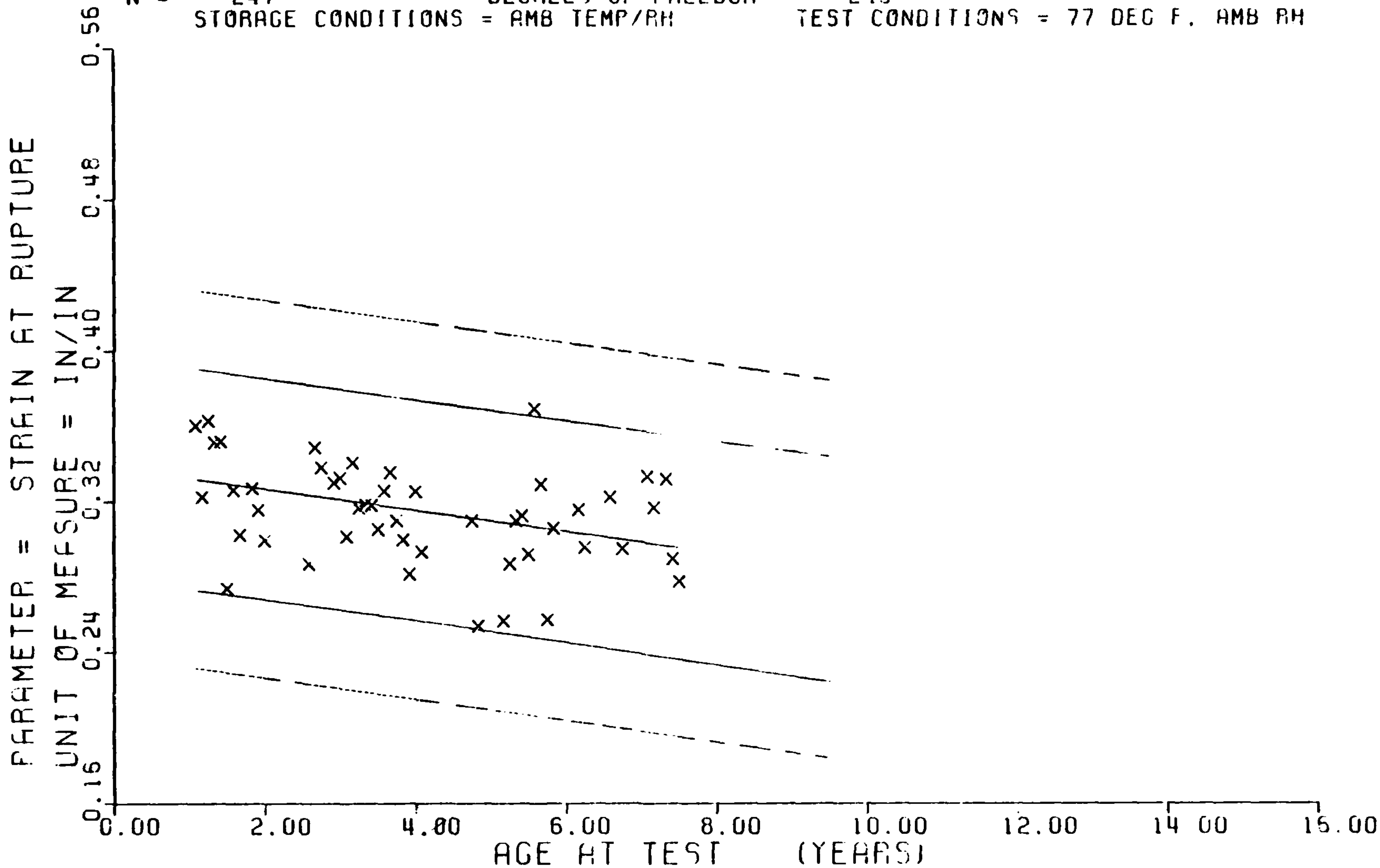
F = +2.5694228E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_T = +3.5016390E-02

R = -3.0809048E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +9.3248382E-05

t = +5.0689474E+00 SIGNIFICANCE OF t = SIGNIFICANT S_E = +3.3381006E-02

N = 247 DEGREES OF FREEDOM = 245

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F. AMB RH

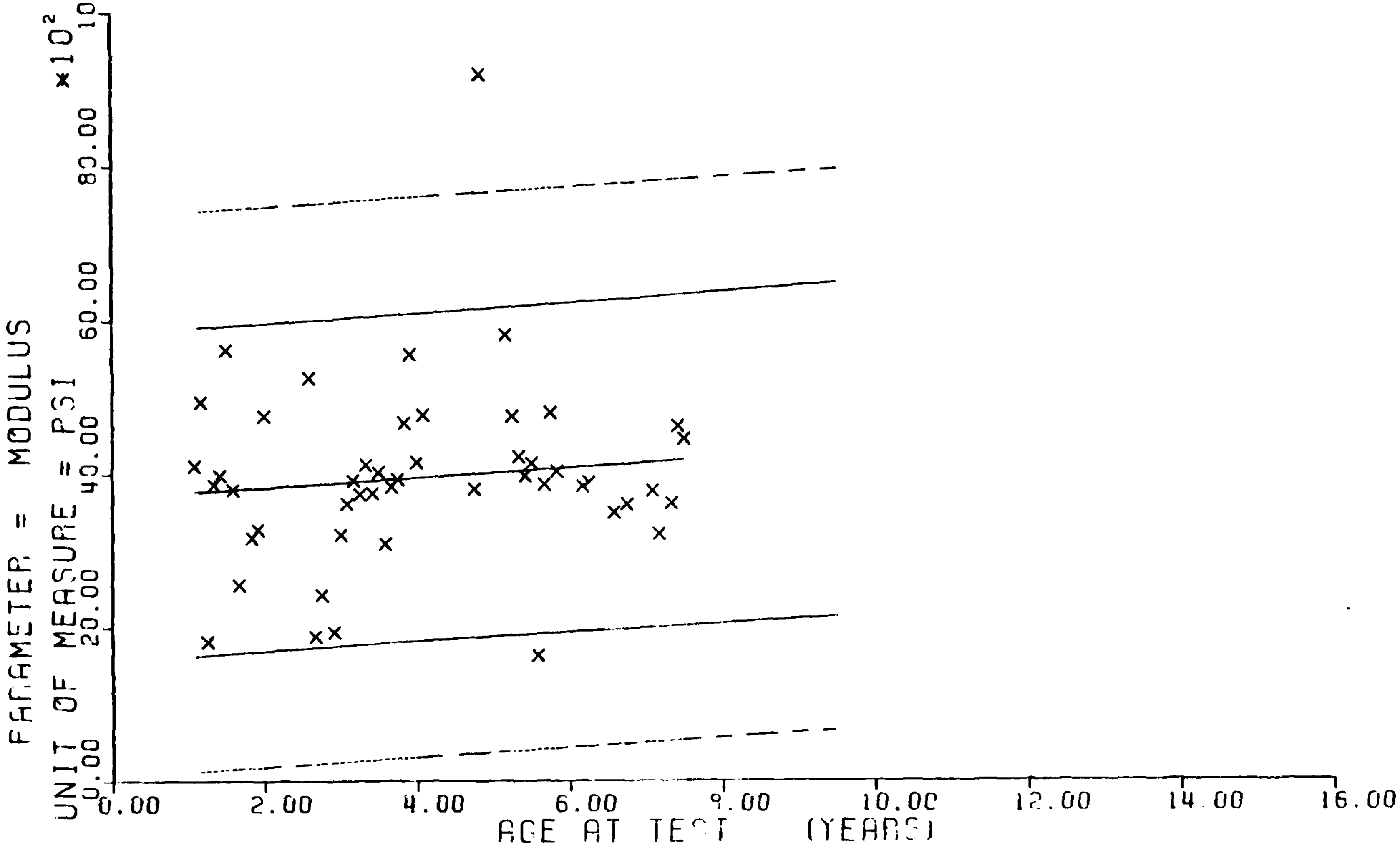


TENSILE RUPTURE STRAIN, ANB-3066 (ANB P-POLY LINED), 1750 IN/MIN, 600 PSI

Figure 5-29

Y = ((+3.7006479E+03) + (+5.2856146E+00) * X)

F = +2.4201617E+00 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_Y = +1.2197797E+03
R = +9.8901903E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT S_B = +3.3976082E+00
t = +1.5556868E+00 SIGNIFICANCE OF t = NOT SIGNIFICANT S_E = +1.2162740E+03
N = 247 DEGREES OF FREEDOM = 245
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F. AMB RH



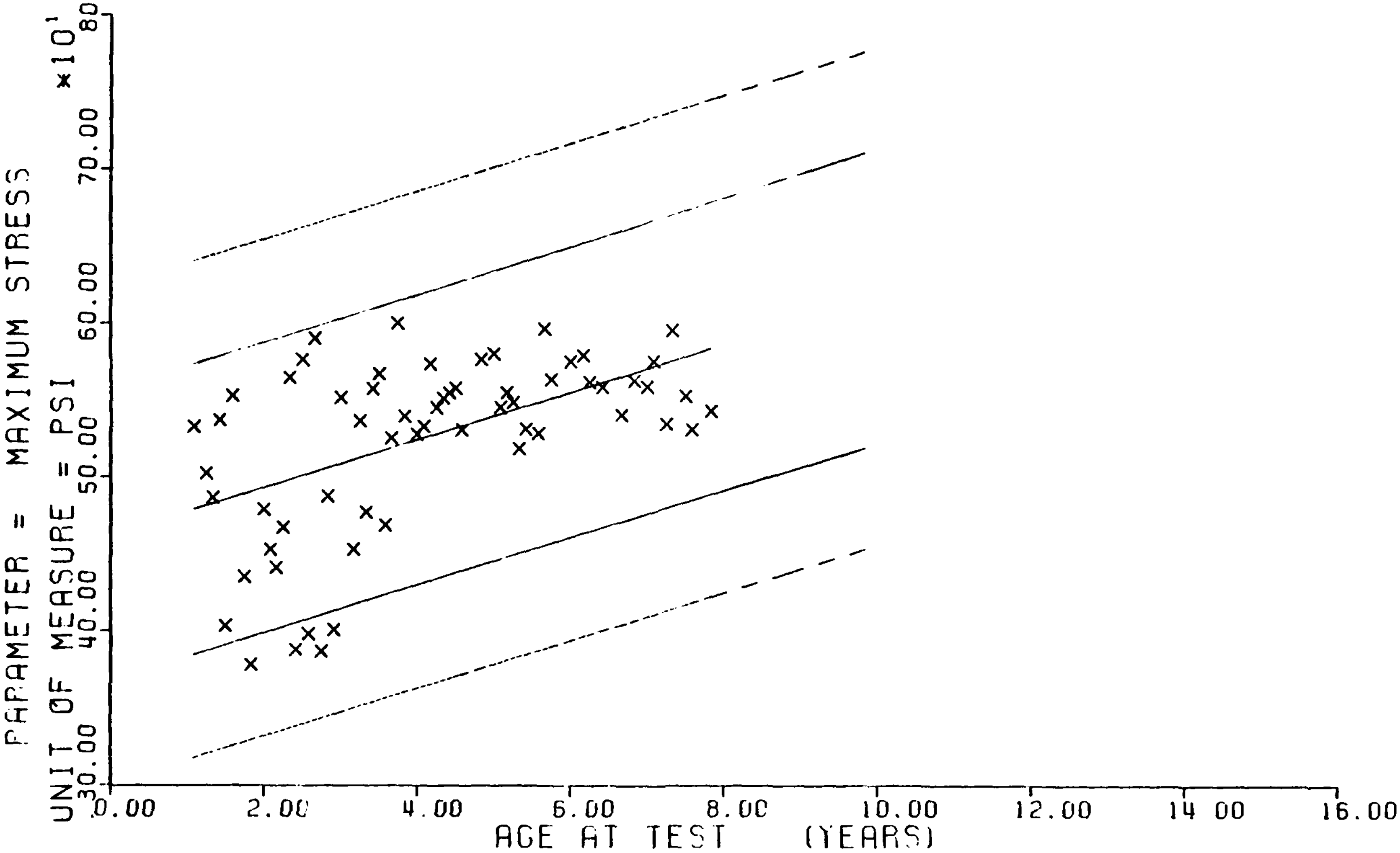
TENSILE MODULUS. ANB-3066 (ANB P-POL) LINED). 1750 IN/MIN. 600 PSI

Figure 5-30

Y = ((+4.6230627E+02) + (+1.2916688E+00) * X)

F = +7.3581596E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +6.0759357E+01
R = +4.6756222E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +1.5057975E-01
t = +8.5779715E+00 SIGNIFICANCE OF t = SIGNIFICANT S_E = +5.3810862E+01
N = 265 DEGREES OF FREEDOM = 263

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



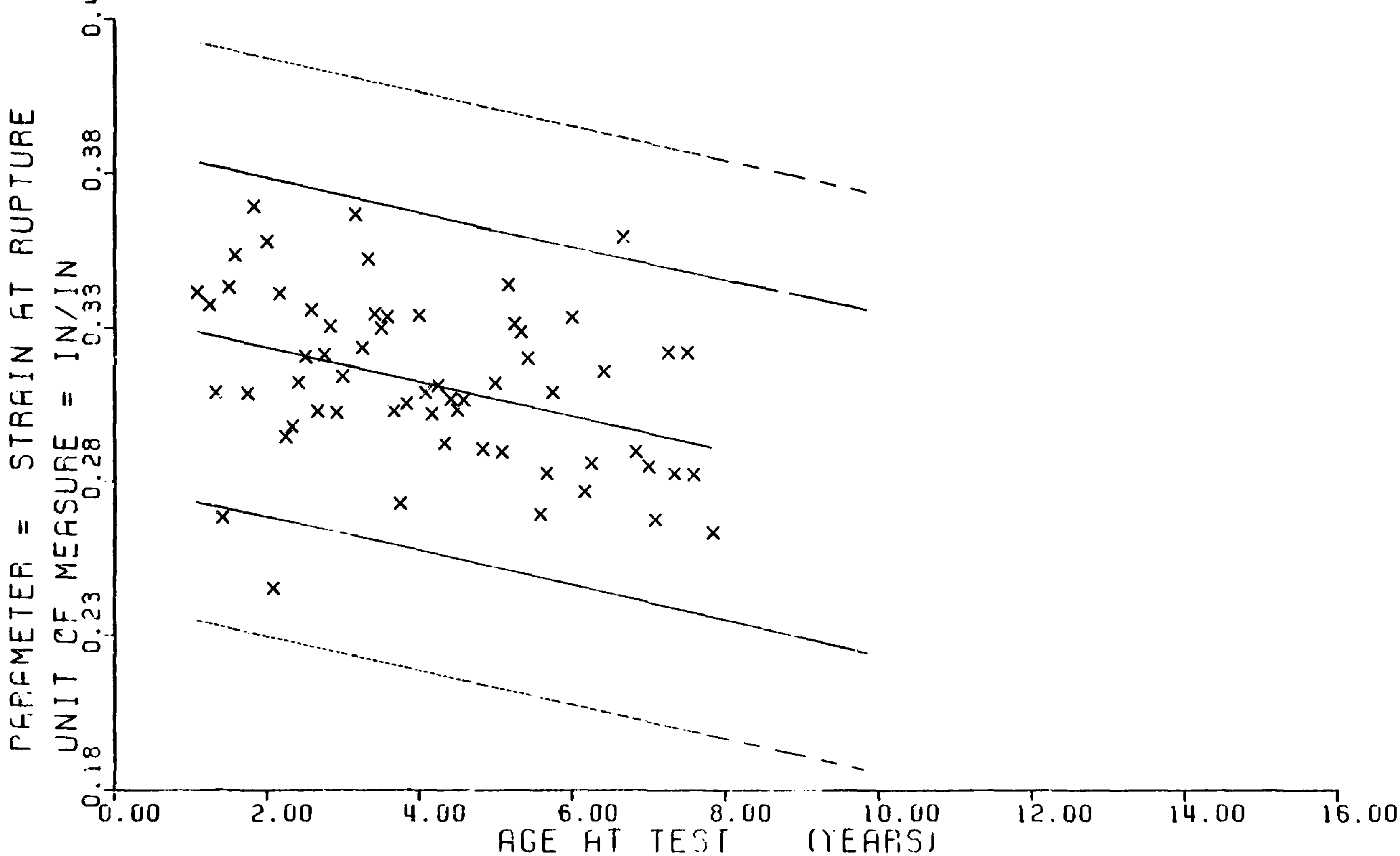
TENSILE MAXIMUM STRESS, ANB-3066 (ANT P-POLY LINED), 1750 IN/MIN, 600 PSI

Figure 5-31

Y = ((+3.3468148E-01) + (-4.6311933E-04) × X)

F = +2.8050290E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_T = +3.2810258E-02
R = -3.1044493E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +8.7442835E-05
t = +5.2962525E+00 SIGNIFICANCE OF t = SIGNIFICANT S_E = +3.1248386E-02
N = 265 DEGREES OF FREEDOM = 263

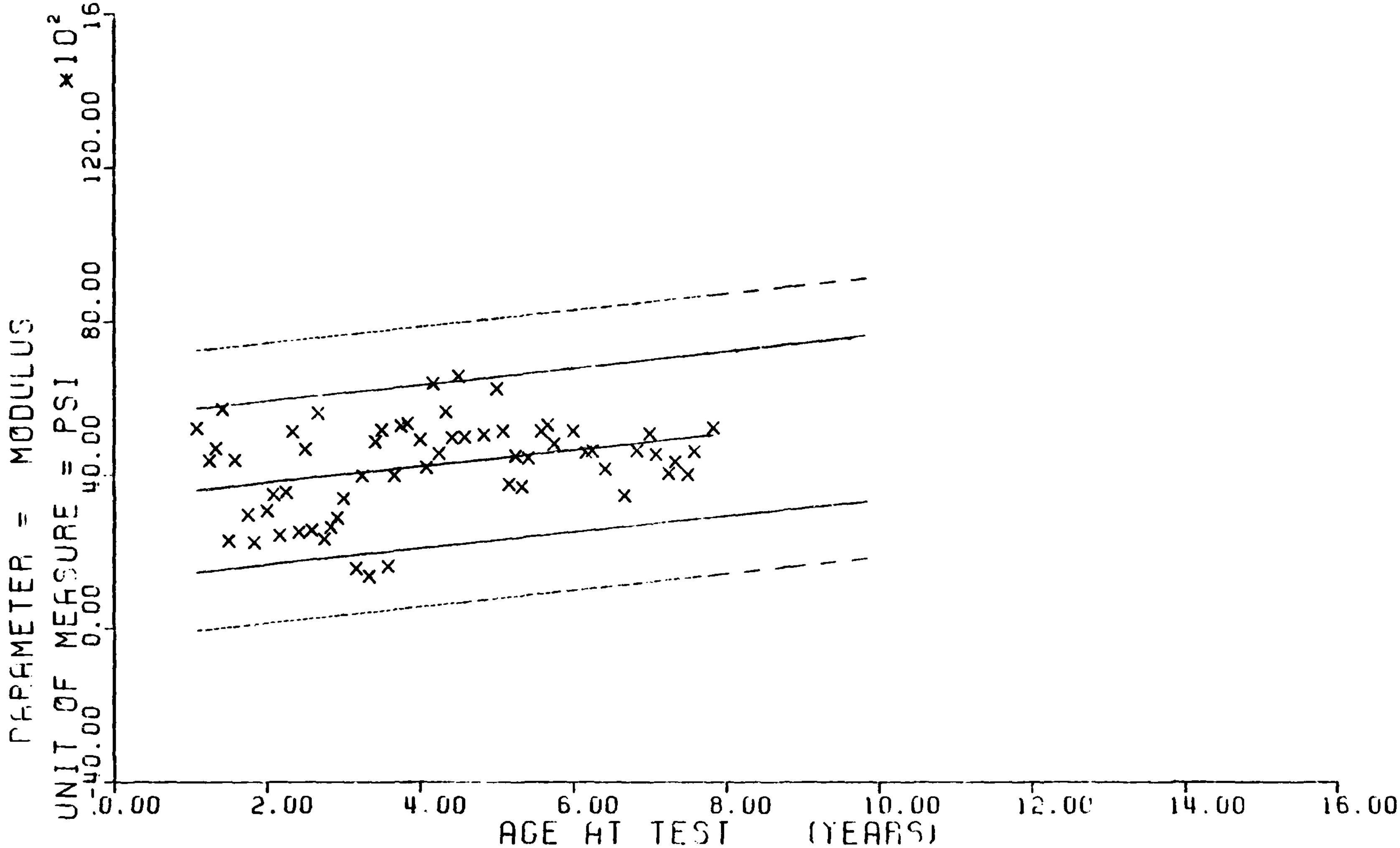
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F. AMB RH



TENSILE RUPTURE STRAIN, ANB-3066 (ANT P-POLY LINED), 1750 IN/MIN, 600 PSI

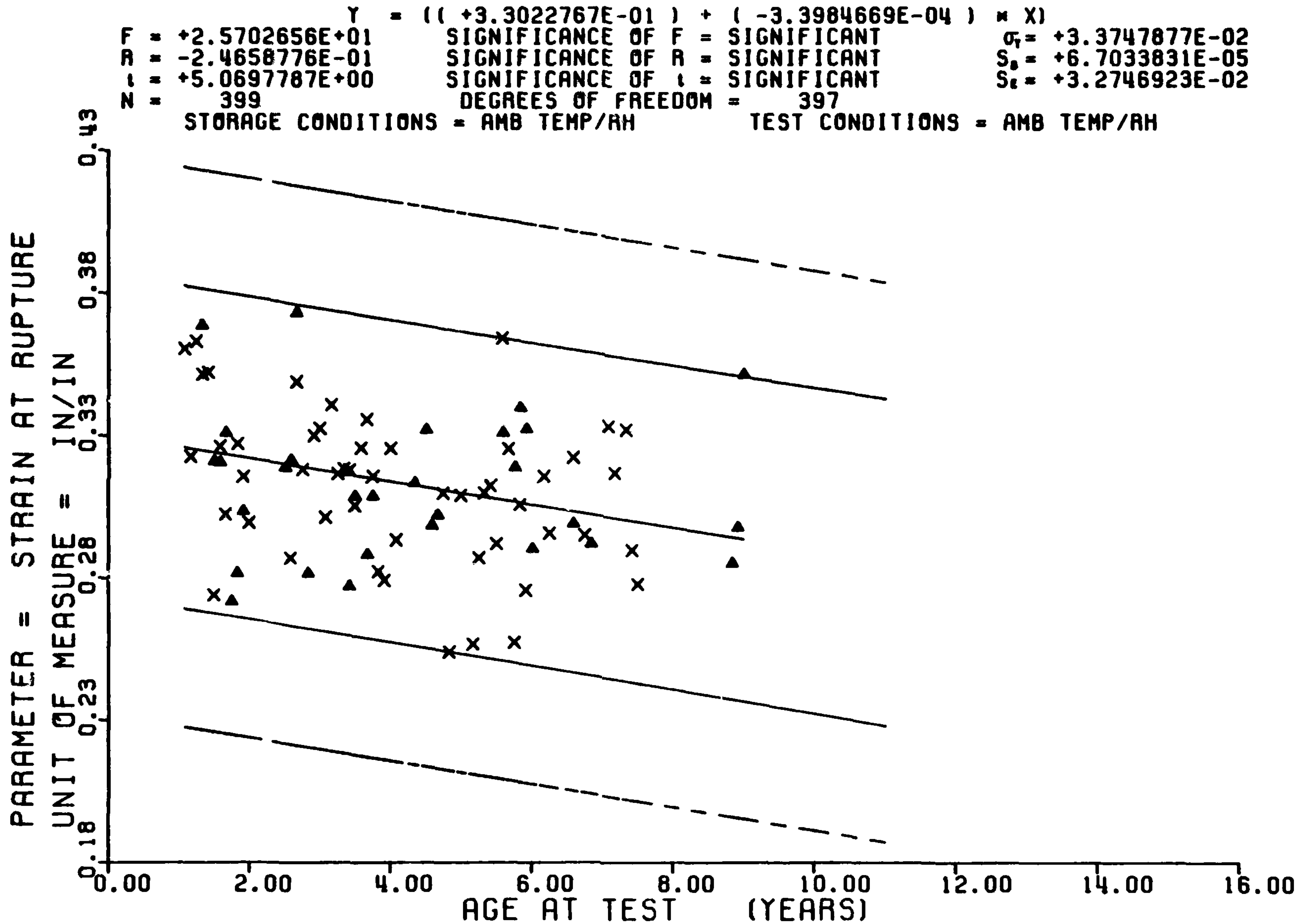
Figure 5-32

Y = ((+3.3605143E+03) + (+1.7879601E+01) * X)
F = +2.7529007E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_1 = +1.2774935E+03
R = +3.0782261E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +3.4077094E+00
ι = +5.2468092E+00 SIGNIFICANCE OF ι = SIGNIFICANT S_E = +1.2177718E+03
N = 265 DEGREES OF FREEDOM = 263
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F. AMB RH



TENSILE MODULUS. ANB-3066 (ANT P-POLY LINED). (750 IN/MIN. 600 PSI

Figure 5-33



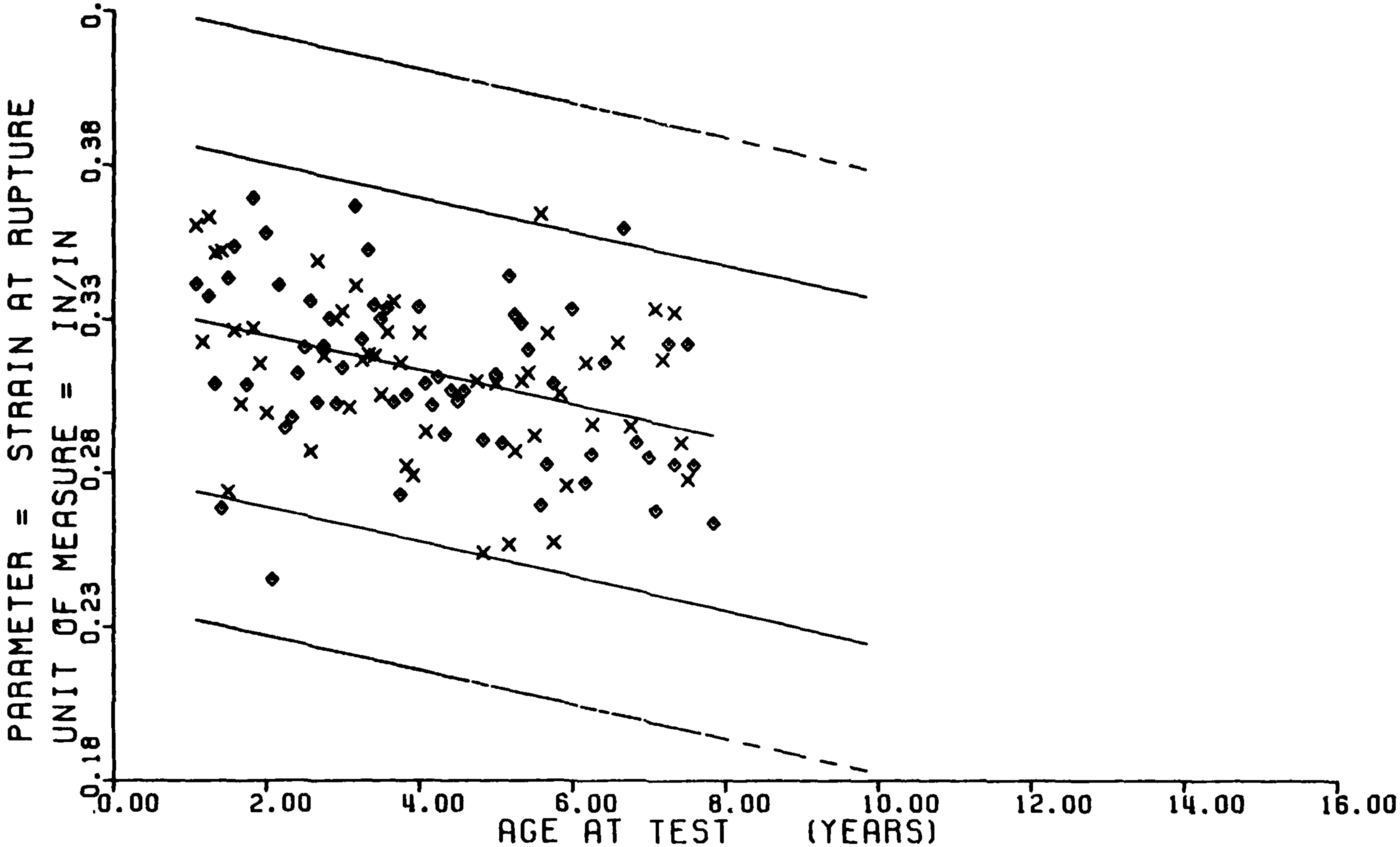
TENSILE HYDRO RUP STRAIN, ANB-3066 (ANB G & P LINED), 1750 IN/MIN 600 PSI

Figure 5-34

Y = ((+3.3597183E-01) + (-4.6731561E-04) × X)

F = +5.5141202E+01   SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +3.4171054E-02
R = -3.0593447E-01   SIGNIFICANCE OF R = SIGNIFICANT S_B = +6.2932092E-05
t = +7.4257122E+00   SIGNIFICANCE OF t = SIGNIFICANT S_E = +3.2563086E-02
N = 536   DEGREES OF FREEDOM = 534

STORAGE CONDITIONS = AMB TEMP/RH   TEST CONDITIONS = AMB TEMP/RH



TENSILE HYDRO RUP STRAIN, ANB-3066 (ANB P & ANT P LINED), 1750 IN/MIN 600 PSI

Figure 5-35

Y = ((+3.2763177E-01) + (-3.2719156E-04) × X)

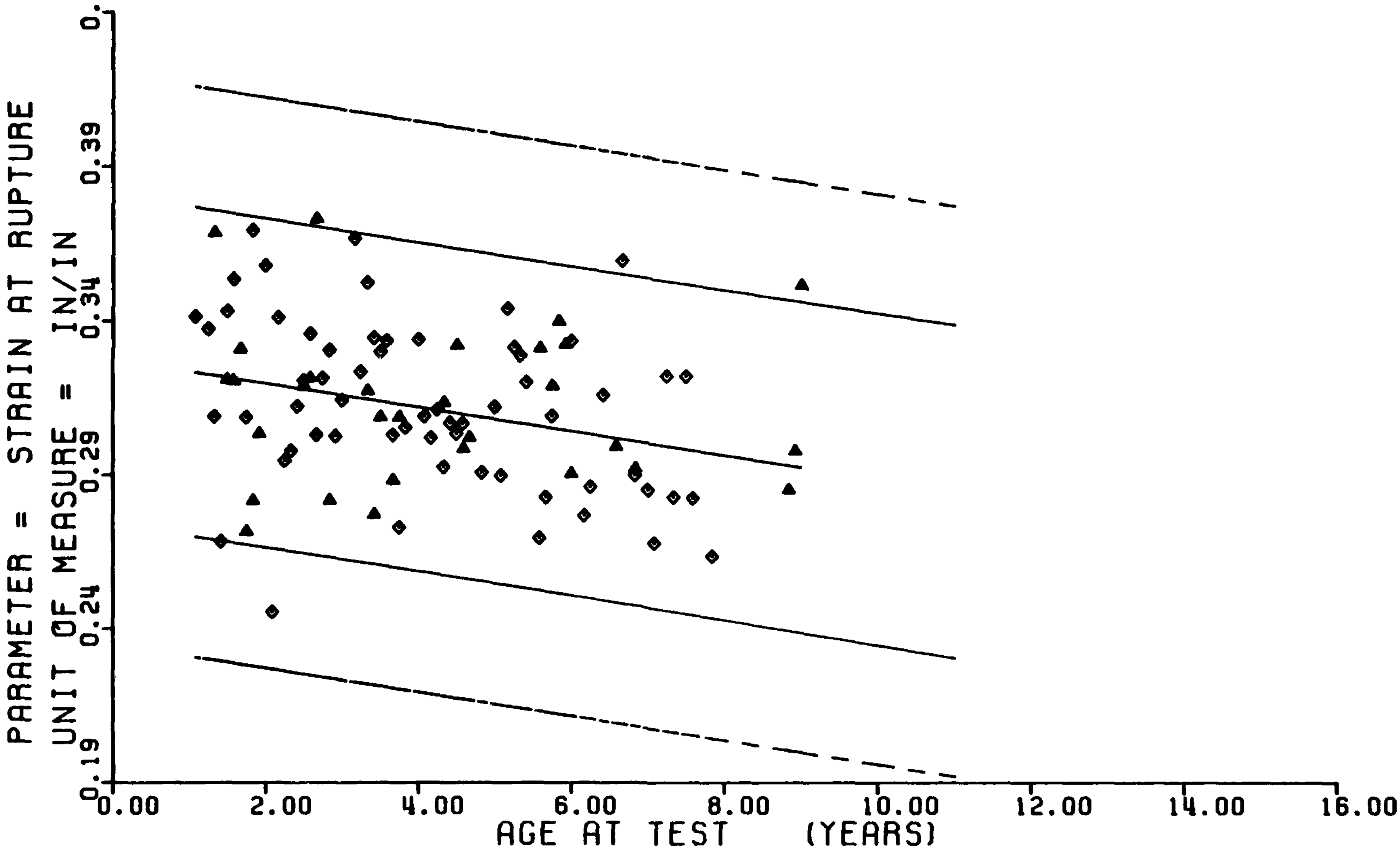
F = +2.5411694E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_T = +3.1809887E-02

R = -2.4703321E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +6.4906066E-05

t = +5.0410013E+00 SIGNIFICANCE OF t = SIGNIFICANT S_ε = +3.0863396E-02

N = 393 DEGREES OF FREEDOM = 391

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



TENSILE HYDRO RUP STRAIN, ANB-3066 (ANB G & ANT P LINED), 1750 IN/MIN 600 PSI

Figure 5-36

SECTION VI

STRESS RELAXATION AND STRAIN DILATATION

A. Stress Relaxation:

An end bonded 1/2" x 1/2" x 4" specimen (1.27 x 1.27 x 10.16 cm) is tested on the stress relaxometer. Load is applied at 2 in/min (0.085 cm/sec). Timing begins when the load is applied. Specimens have been strained at both 1% and 3%.

The use of 1% strain over the range of temperatures was not introduced into the program until Phase 3 of Minuteman III testing Phase B Series 2 for Minuteman II. In this report, data for both 1% 3% at 77°F are show for a comparison between applied strains. (T. has shown that strains introduced into the propellant during machining remain in the samples and a higher strain is required to give reproducible and accurate relaxation moduli.) The 1% strain is considered to be very marginal insofar as reproducible data is concerned.

Table 6-1 gives the significance of 't' for both 1% and 3% strains. The number of specimens represented in each regression is shown so that the preponderance of test data at 3% strain is obvious.

Unlined cartons of ANB G show a significant decrease for 1% strain at 1000 sec. Lined cartons show a significant increase at 3%.

Unlined cartons of ANB P show a significant increase at 1% and 3% at 10 sec, but the 1000 second modulus at 3% shows a significant increase.

Unlined cartons of ANT P do not show a significant decrease at 1%, but the decrease is significant at 3%. Lined cartons continue to show a significant increase.

Gradient stress relaxation shows that the minima occurs at approximately 1.8 inches from the liner. At 1000 seconds and 2.5 inches ANB G

shows a marked increase in modulus whereas ANB P shows a decrease.

B. Strain Dilatation:

The same type of specimen is used for this test as for stress relaxation. Testing is done utilizing a gas dilatometer at 77°F (25°C) without pressure.

Poisson's ratio at 15% strain consistently shows a significant decrease (Table 6-2) except for ANB G unlined cartons. At maximum strain, Poisson's ratio is significantly decreasing for unlined cartons for P-polymer

TABLE 6-1

STRESS RELAXATION

Significance of Regression Slopes

System	10 sec		10 sec		1000 sec	
	N	1%	N	3%	1%	3%
ANB G Unlined	192	NS	448	NS	Sig dec	NS
ANB P Unlined	171	Sig inc	358	Sig inc	Sig inc	NS
ANT P Unlined	168	NS	216	Sig dec	NS	Sig dec
ANB G Lined	51	NS	51	Sig inc	NS	Sig inc
ANB P Lined	99	NS	96	Sig inc	NS	Sig inc
ANT P Lined	162	Sig inc	183	Sig inc	Sig inc	Sig inc
ANG & ANT P Unlined					Sig dec	

TABLE 6-2

STRAIN DILATATION

Significance of Regression Slopes

System	Poisson's Ratio at 15% Strain	Poisson's Ratio at Max Strain	Dilatation at Max Strain
ANB G Unlined	Sig inc	NS	Sig inc
ANB P Unlined	Sig dec	Sig dec	NS
ANT P Unlined	Sig dec	Sig dec	NS
ANB G Lined	Sig dec	NS	NS
ANB P Lined	Sig dec	NS	NS
ANT P Lined	Sig dec	NS	Sig dec

TABLE 6-3

ANALYSIS OF COVARIANCE COMPARISON OF REGRESSIONS
FOR STRESS RELAXATION MODULUS

		Seconds at % Strains			
		1% Strain		3% Strain	
Lined Vs Unlined		10	1000	10	1000
ANB P-polymer	Residual Variance	S	S	S	S
	Slope	S	NS	NS	NS
	Elevation	S	S	S	S
ANB G-polymer	Residual Variance	S	S	S	S
	Slope	NS	S	NS	S
	Elevation	S	S	NS	NS
ANT P-polymer	Residual Variance	S	S	S	S
	Slope	S	S	S	S
	Elevation	NS	NS	S	S
ANB P Unlnd Vs ANT P Lined	Residual Variance	S	S	S	S
	Slope	NS	NS	NS	S
	Elevation	NS	NS	NS	NS
G-polymer Vs P-polymer					
ANB Lined	Residual Variance	NS	NS	S	S
	Slope	NS	NS	NS	NS
	Elevation	S	NS	NS	NS
ANB Unlined	Residual Variance	S	S	S	S
	Slope	S	S	S	S
	Elevation	S	S	S	S
ANB G Unlnd Vs ANT P Unlnd	Residual Variance	NS	NS	S	S
	Slope	NS	NS	S	S
	Elevation	S	NS	S	S
ANB G Lined Vs ANT P Lined	Residual Variance	S	S	S	S
	Slope	NS	S	NS	NS
	Elevation	S	S	S	S
ANB P-polymer Vs ANT P-polymer					
Lined	Residual Variance	NS	NS	NS	NS
	Slope	S	S	NS	NS
	Elevation	S	S	S	S
Unlined	Residual Variance	S	S	S	S
	Slope	S	S	S	S
	Elevation	NS	S	S	S

Y = ((+7.5486878E+02) + (-8.1109145E-01) * X)

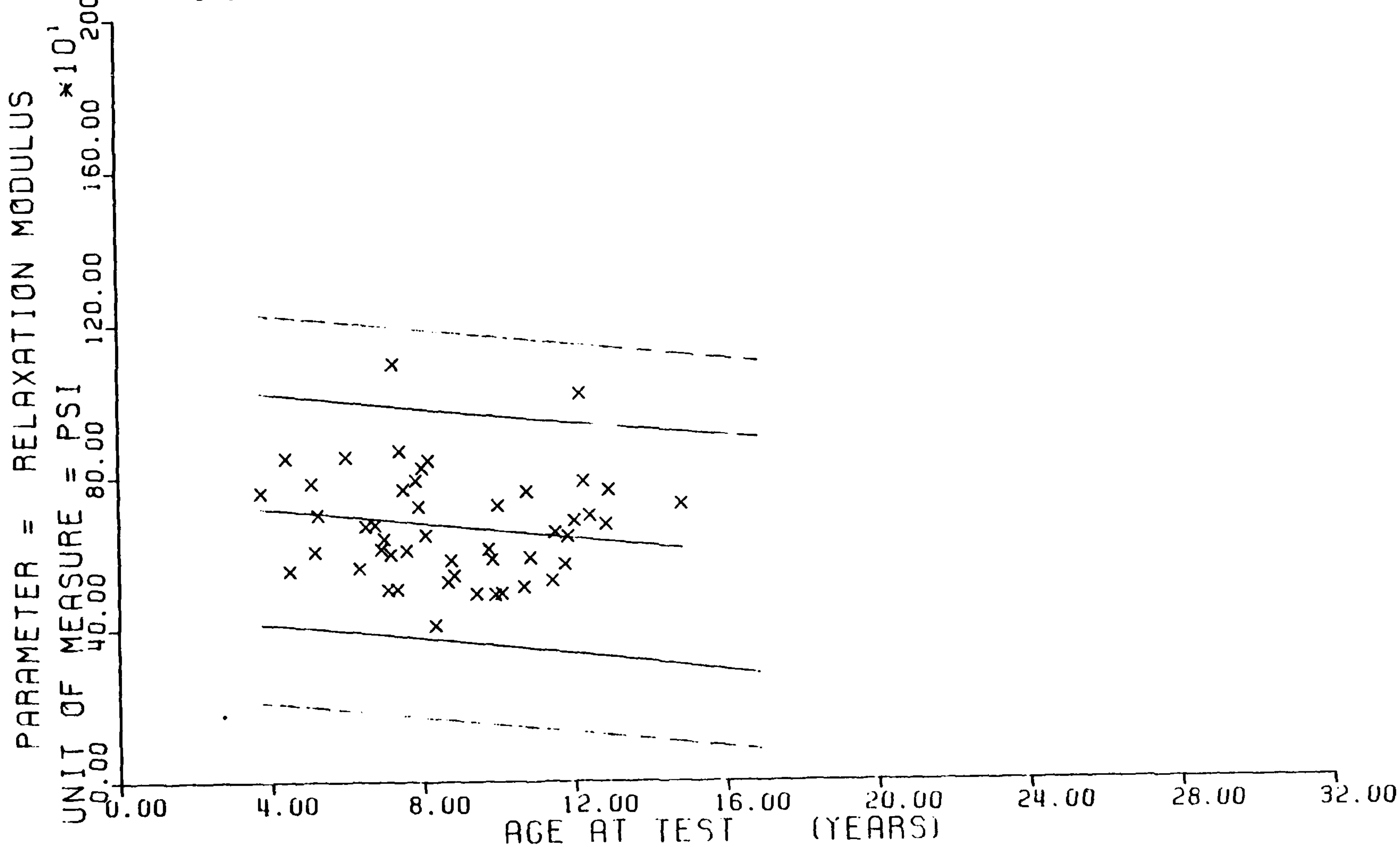
F = +3.6537608E+00 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_Y = +1.7057619E+02

R = -1.3735899E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT S_B = +4.2432612E-01

t = +1.9114813E+00 SIGNIFICANCE OF t = NOT SIGNIFICANT S_t = +1.6940340E+02

N = 192 DEGREES OF FREEDOM = 190

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F. AMB RH

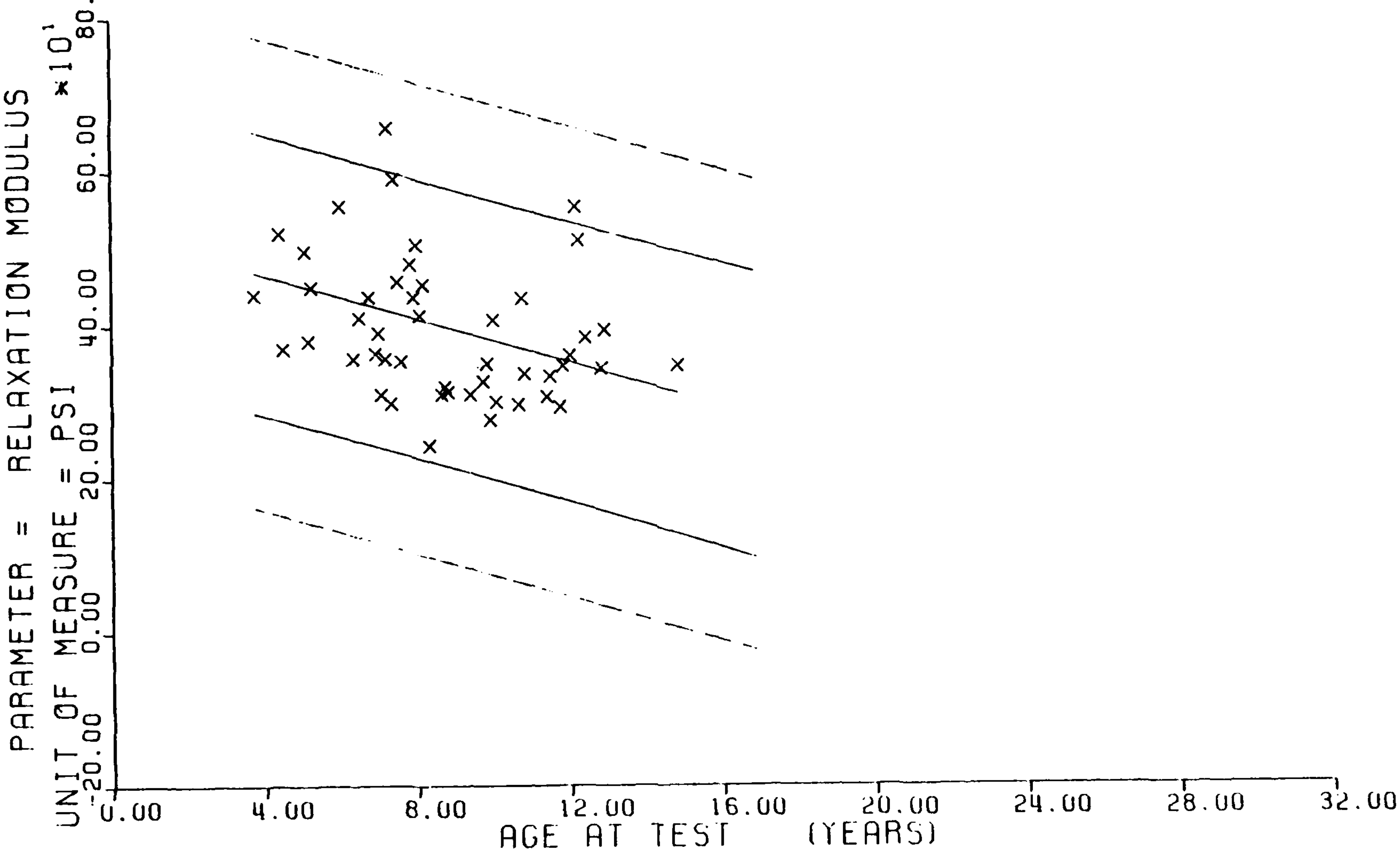


STRESS RELAXATION MODULUS, ANB-3066 (ANB G-POLYMER UNLND), 10 SEC, 1% STRAIN

Figure 6-1

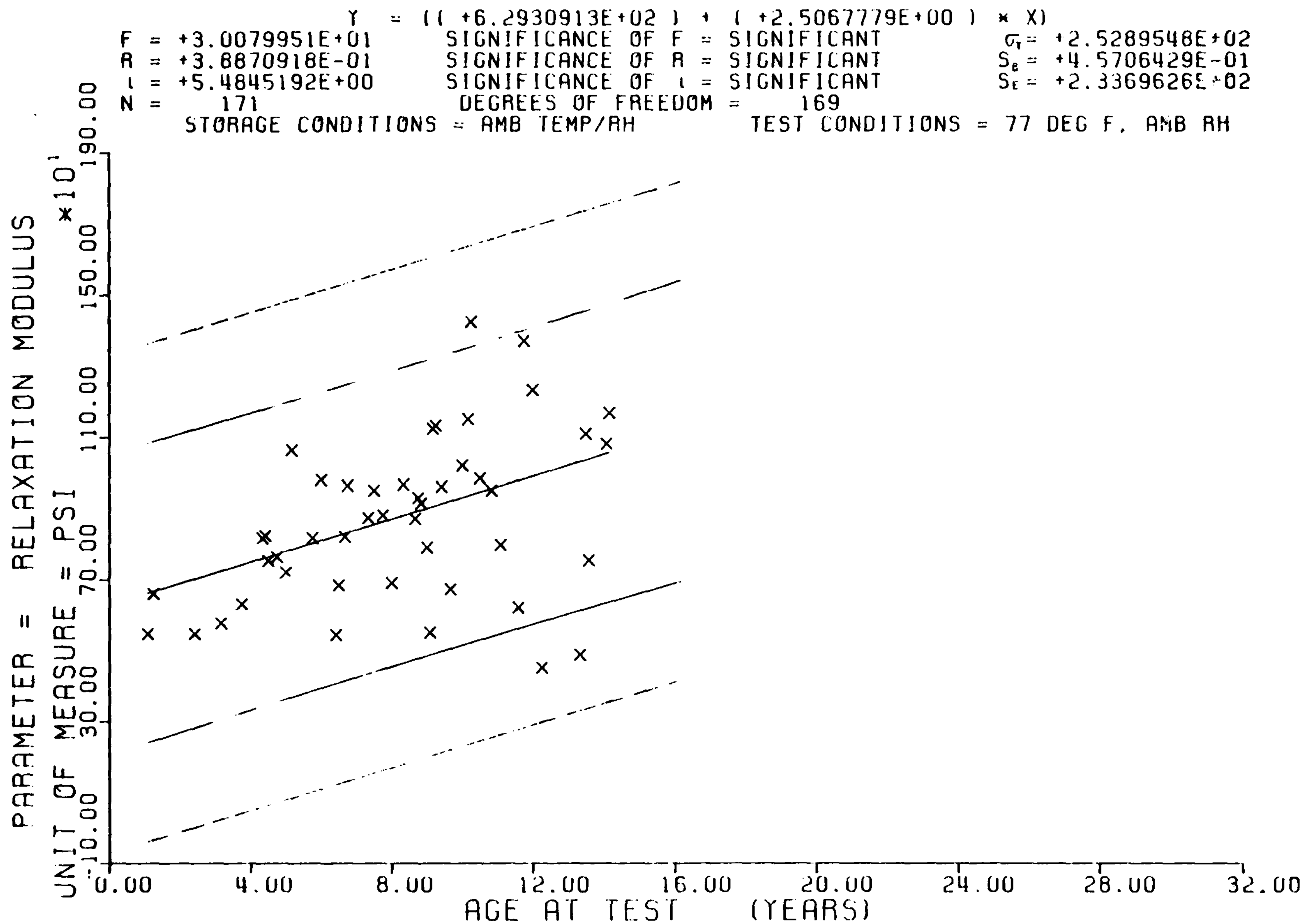
Y = ((+5.2311732E+02) + (-1.1904739E+00) * X)

F = +2.1655691E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_T = +1.0751140E+02
R = -3.1986818E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +2.5581963E-01
t = +4.6535675E+00 SIGNIFICANCE OF t = SIGNIFICANT S_E = +1.0213068E+02
N = 192 DEGREES OF FREEDOM = 190
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F. AMB RH



STRESS RELAXATION MODULUS, ANB-3066 (ANB G-POLYMER UNLND), 1000 SEC, 1% STRAIN

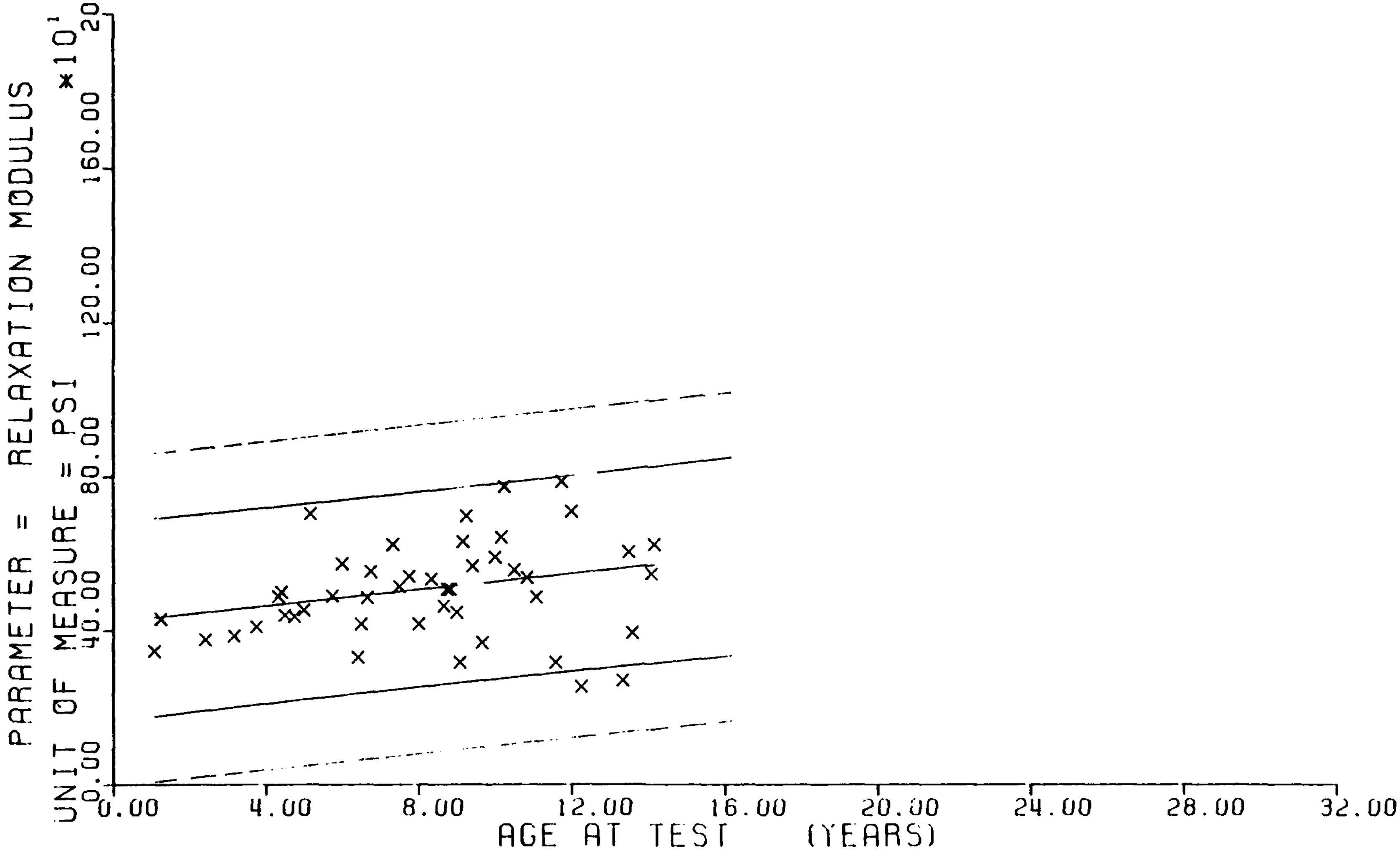
Figure 6-2



STRESS RELAXATION MODULUS, ANB-3066 (ANB P-POLYMER UNLND), 10 SEC, 1% STRAIN

Figure 6-3

Y = ((+4.2289356E+02) + (+8.6719416E-01) * X)
F = +9.7038015E+00 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +1.4593595E+02
R = +2.3302582E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +2.7838472E-01
t = +3.1150925E+00 SIGNIFICANCE OF t = SIGNIFICANT S_E = +1.4233767E+02
N = 171 DEGREES OF FREEDOM = 169
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH

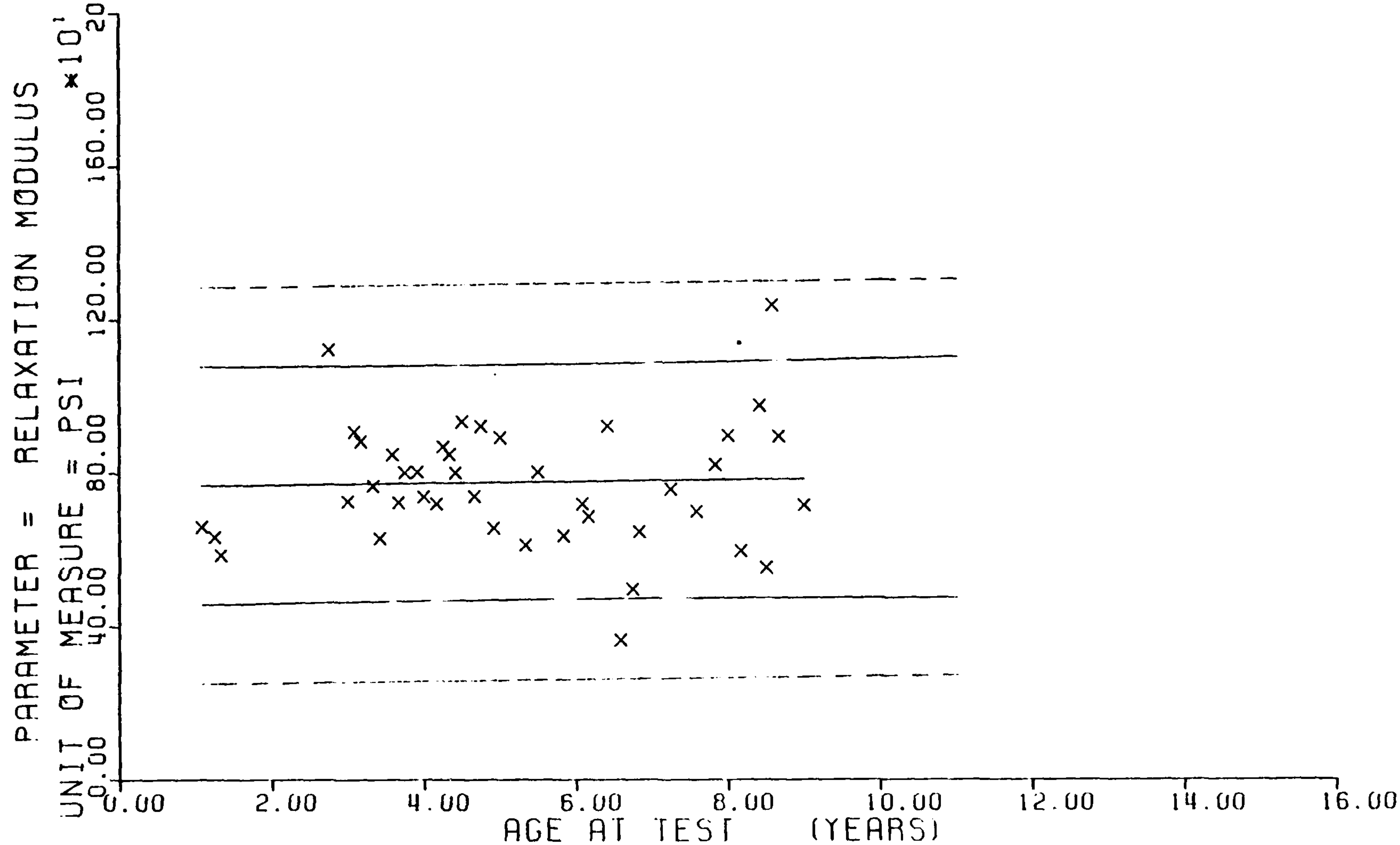


STRESS RELAXATION MODULUS, ANB-3066 (ANB P-POLYMER UNLND), 1000 SEC, 1% STRAIN

Figure 6-4

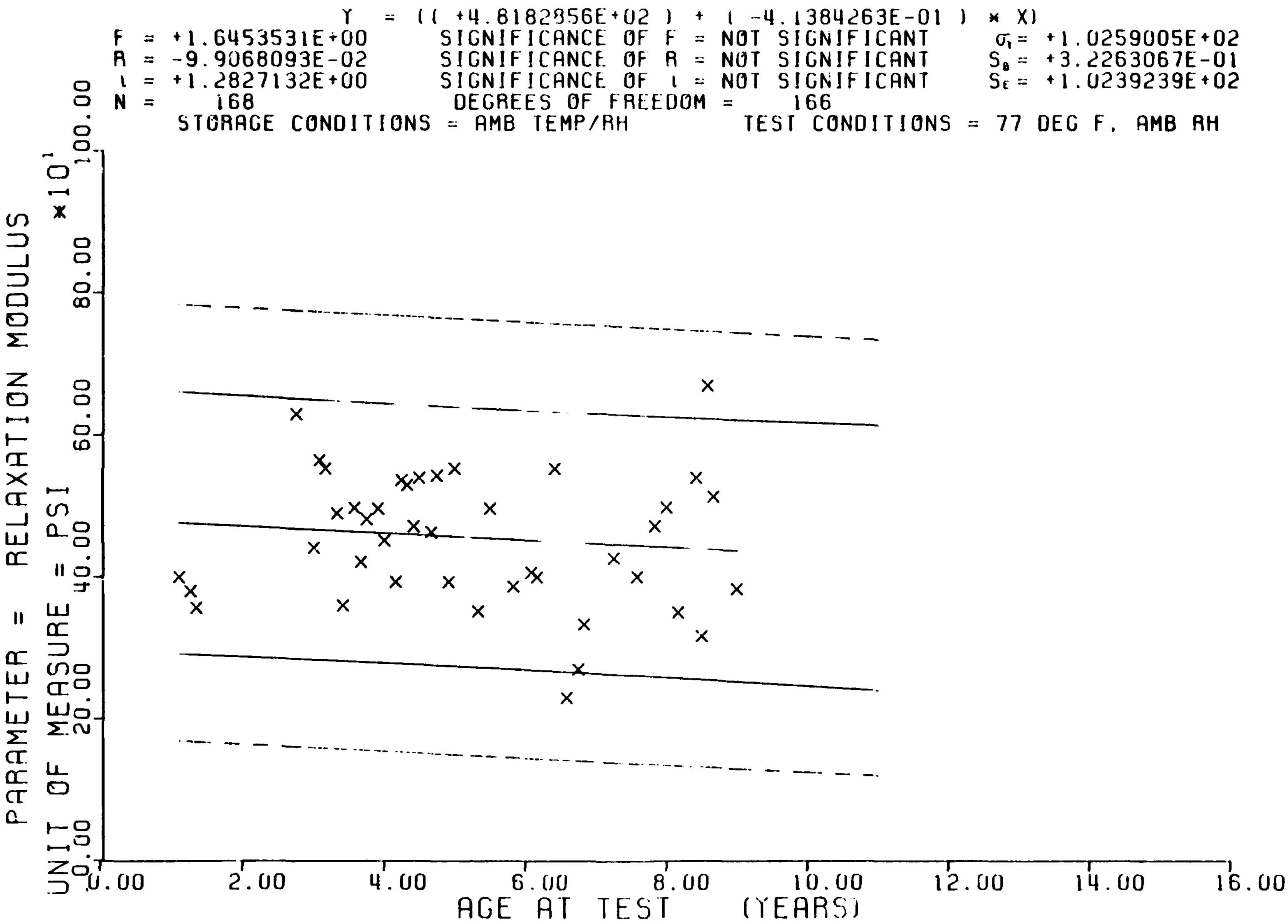
Y = ((+7.6536534E+02) + (+1.8553730E-01) * X)

F = +1.1642561E-01   SIGNIFICANCE OF F = NOT SIGNIFICANT σ_Y = +1.7211435E+02
R = +2.6473903E-02   SIGNIFICANCE OF R = NOT SIGNIFICANT S_B = +5.4375964E-01
ι = +3.4121198E-01   SIGNIFICANCE OF ι = NOT SIGNIFICANT S_E = +1.7257148E+02
N = 168   DEGREES OF FREEDOM = 166
STORAGE CONDITIONS = AMB TEMP/RH   TEST CONDITIONS = 77 DEG F, AMB RH



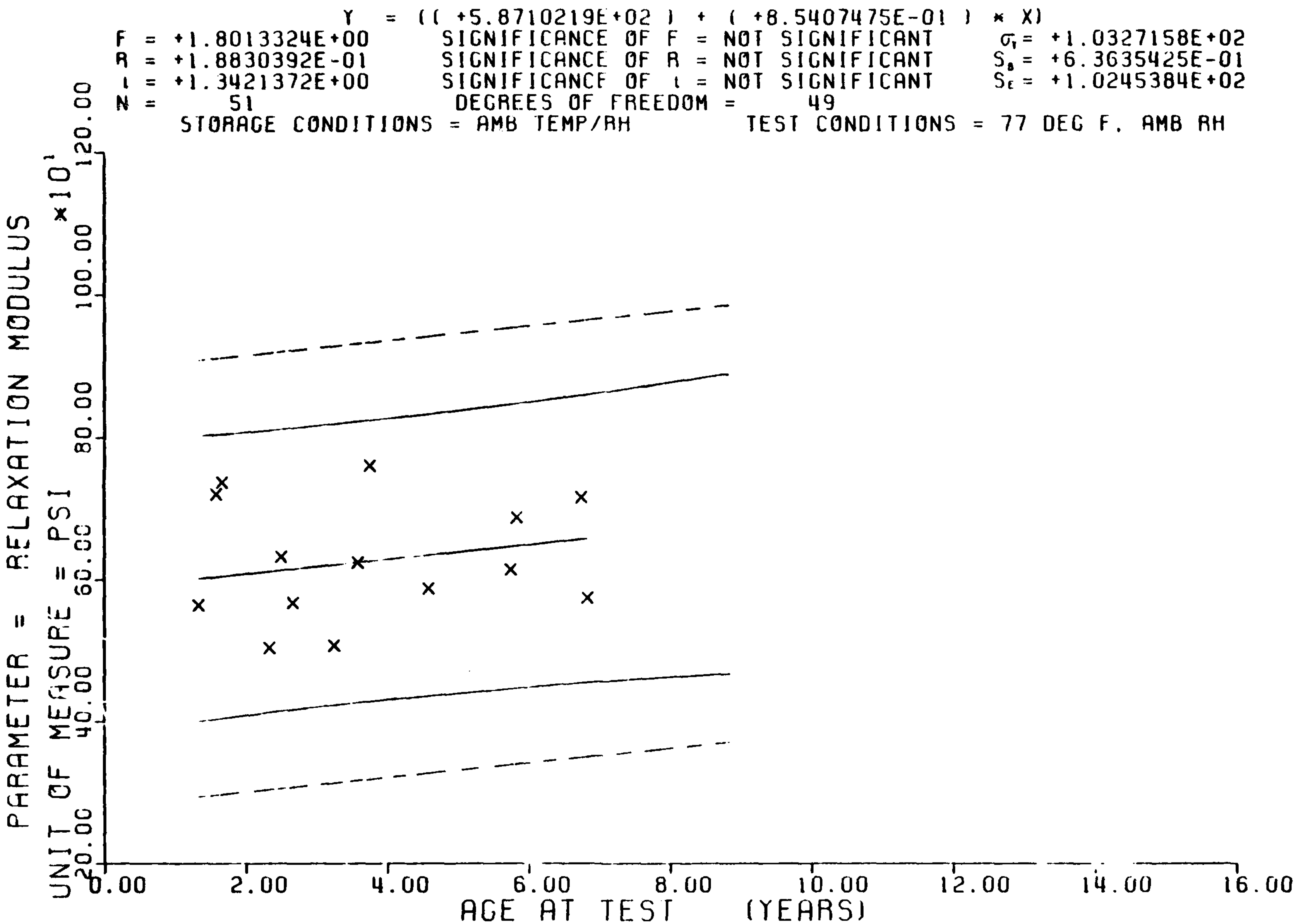
STRESS RELAXATION MODULUS, ANB-3066 (ANT P-POLYMER UNLND), 10 SEC, 1% STRAIN

Figure 6-5



STRESS RELAXATION MODULUS, ANB-3066 (ANT P-POLYMER UNLND), 1000 SEC, 1% STRAIN

Figure 6-6



STRESS RELAXATION MODULUS, ANB-3066 (ANB G-POLYMER LINED), 10 SEC. 1% STRAIN

Figure 6-7

Y = ((+3.9063558E+02) + (+2.8541019E-01) * X)

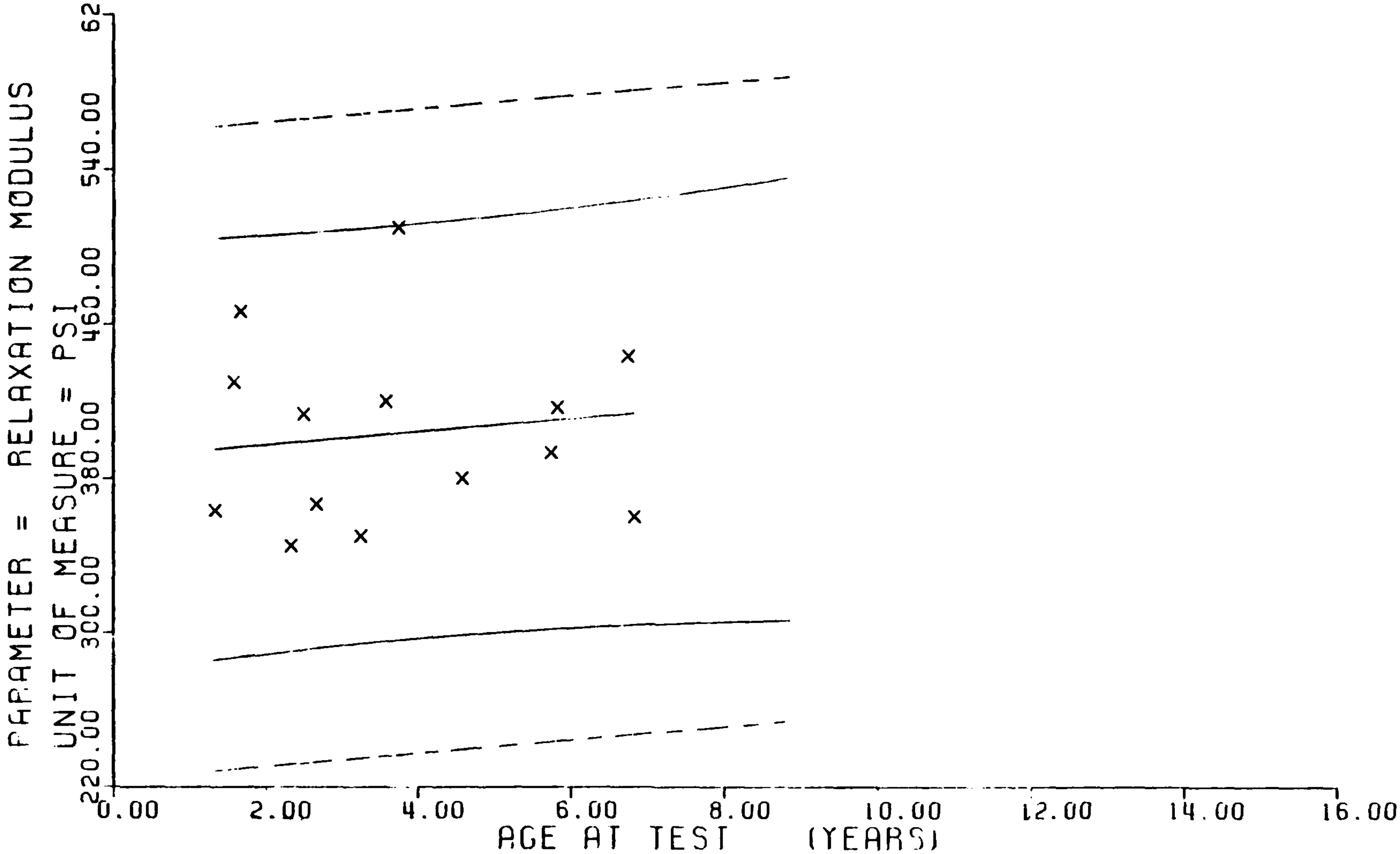
F = +6.8134933E-01   SIGNIFICANCE OF F = NOT SIGNIFICANT σ_Y = +5.5491387E+01

R = +1.1710844E-01   SIGNIFICANCE OF R = NOT SIGNIFICANT S_B = +3.4576781E-01

t = +8.2543887E-01   SIGNIFICANCE OF t = NOT SIGNIFICANT S_E = +5.5669061E+01

N = 51   DEGREES OF FREEDOM = 49

STORAGE CONDITIONS = AMB TEMP/RH   TEST CONDITIONS = 77 DEG F, AMB RH



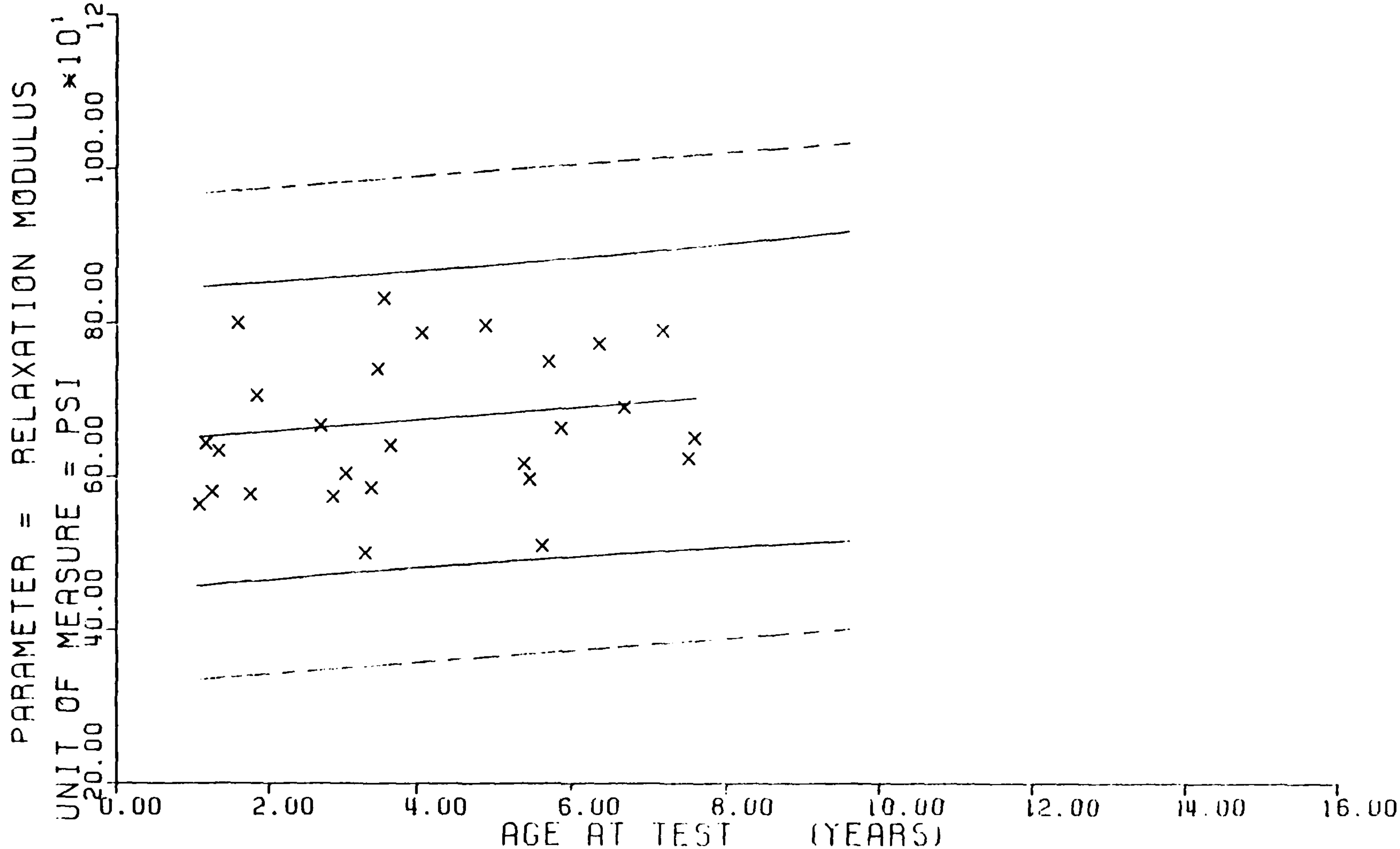
STRESS RELAXATION MODULUS, ANB-3066 (ANB G-POLYMER LINED), 1000 SEC, 1% STRAIN

Figure 6-8

Y = ((+6.4309305E+02) + (+6.4563671E-01) * X)

F = +2.0380471E+00 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_Y = +1.0606363E+02
R = +1.4345182E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT S_B = +4.5225264E-01
t = +1.4276018E+00 SIGNIFICANCE OF t = NOT SIGNIFICANT S_E = +1.0550632E+02
N = 99 DEGREES OF FREEDOM = 97

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH

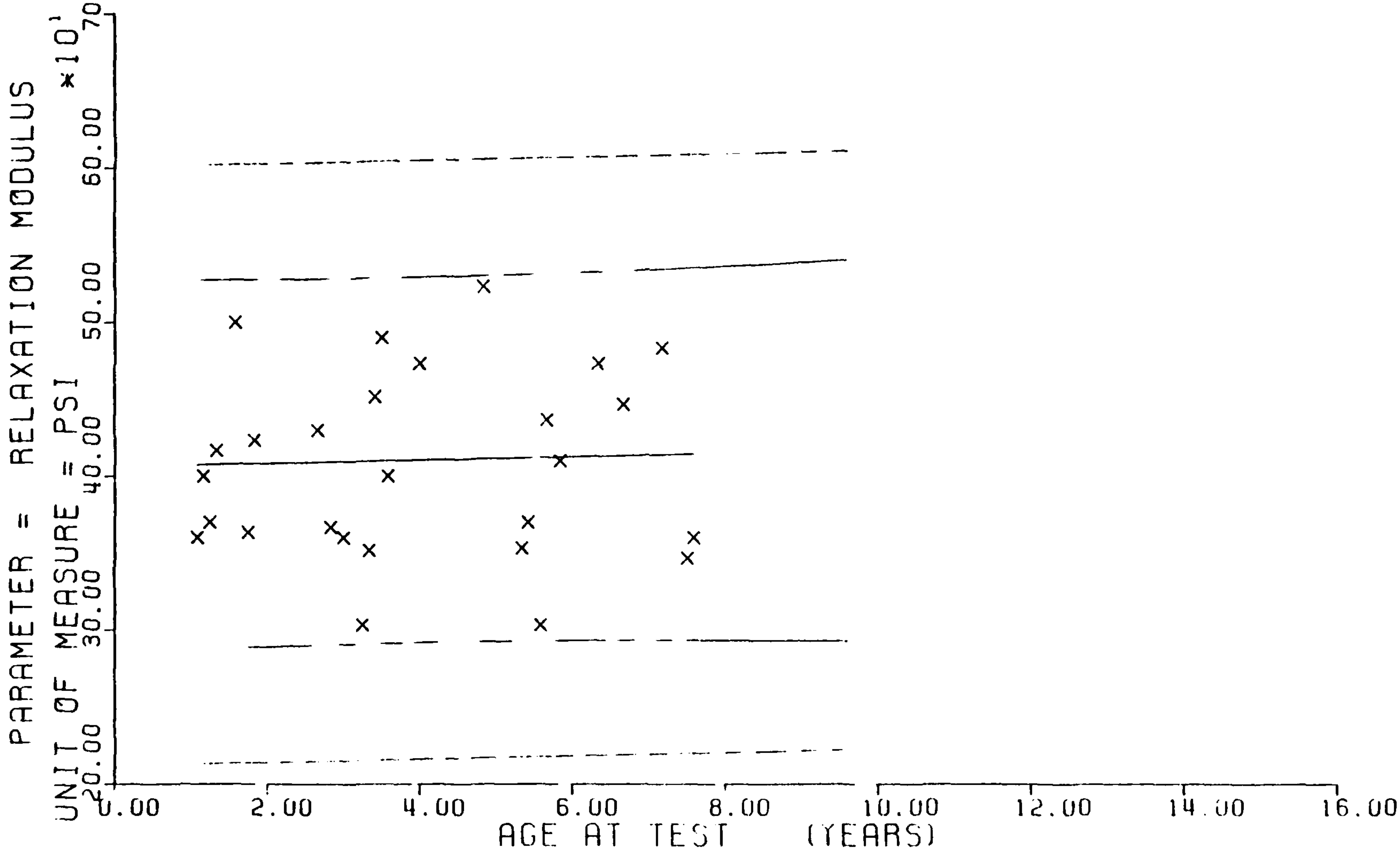


STRESS RELAXATION MODULUS, ANB-3066 (ANB P-POLYMER LINED), 10 SEC, 1% STRAIN

Figure 6-9

Y = ((+4.0625912E+02) + (+8.9693264E-02) * X)

F = +1.0415892E-01   SIGNIFICANCE OF F = NOT SIGNIFICANT σ_Y = +6.4537905E+01
R = +3.2751359E-02   SIGNIFICANCE OF R = NOT SIGNIFICANT S_B = +2.7791474E-01
ι = +3.2273662E-01   SIGNIFICANCE OF ι = NOT SIGNIFICANT S_ι = +6.4834921E+01
N = 99   DEGREES OF FREEDOM = 97
STORAGE CONDITIONS = AMB TEMP/RH   TEST CONDITIONS = 77 DEG F, AMB RH



RELAXATION MODULUS, ANB-3066 (ANB P-POLYMER LINED), 1000 SEC, 1% STRAIN

Figure 6-10

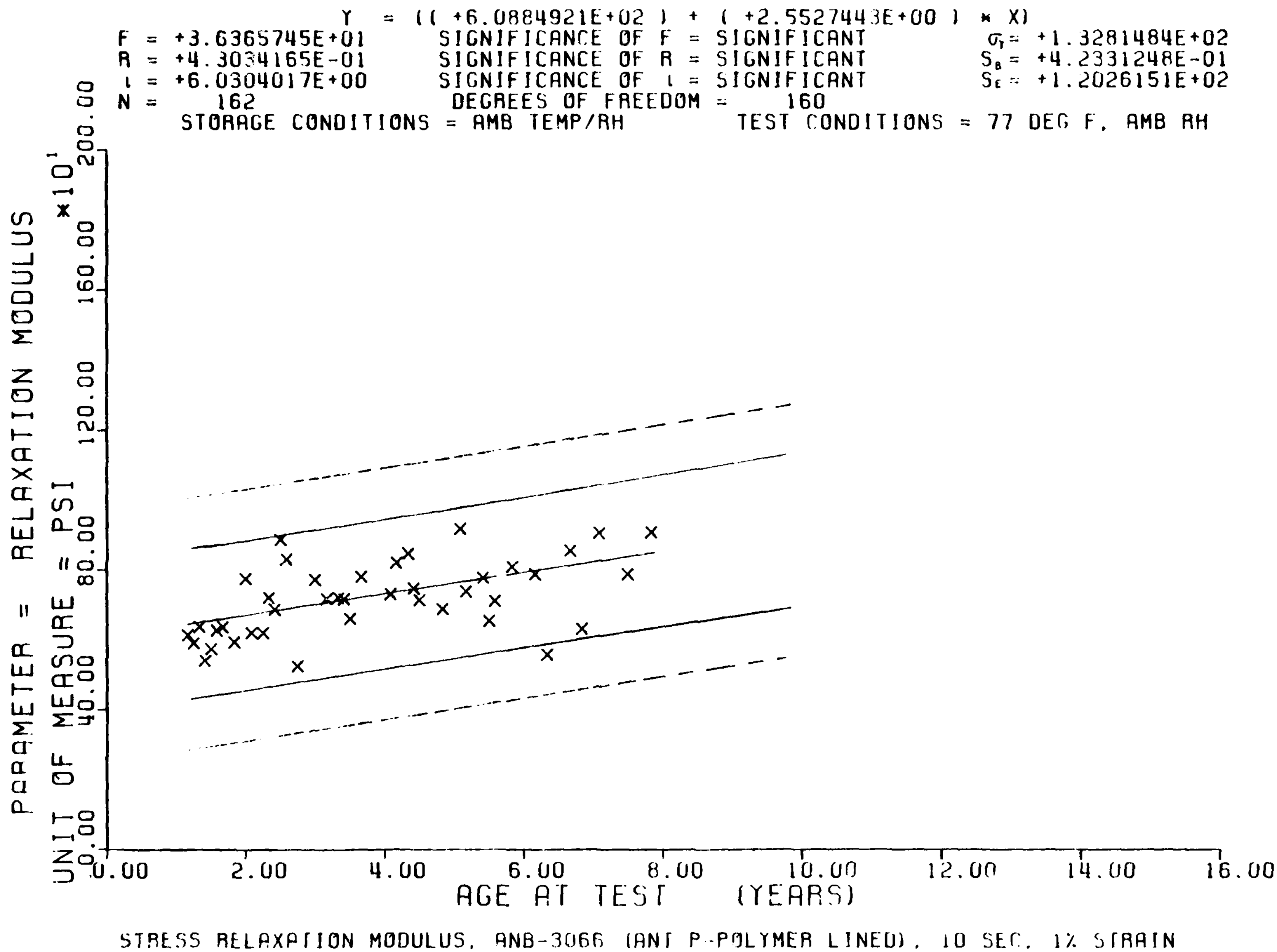
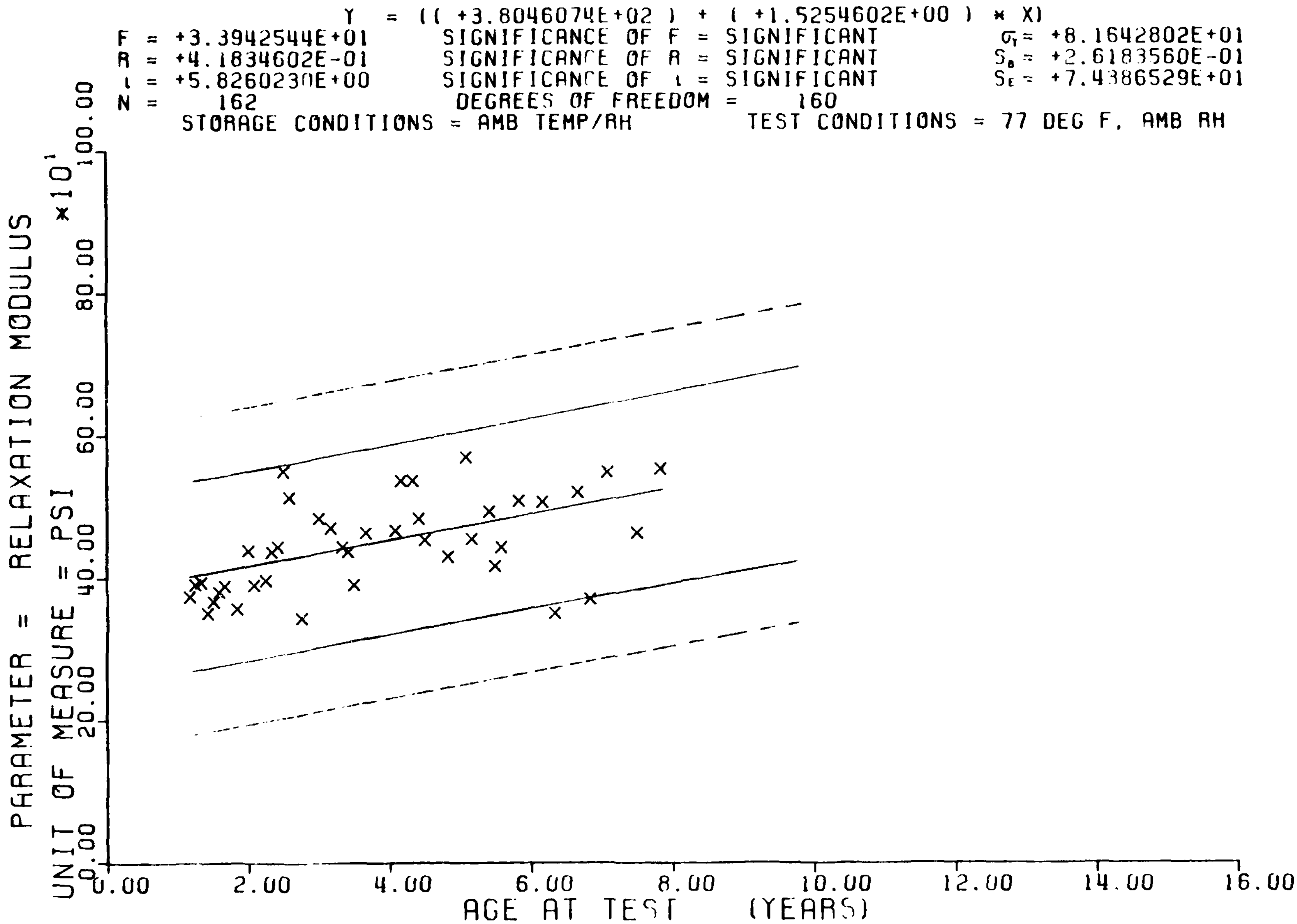

Y = ((+6.0884921E+02) + (+2.5527443E+00) * X)
F = +3.6365745E+01 SIGNIFICANCE OF F = SIGNIFICANT σT = +1.3281484E+02
R = +4.3034165E-01 SIGNIFICANCE OF R = SIGNIFICANT SB = +4.2331248E-01
t = +6.0304017E+00 SIGNIFICANCE OF t = SIGNIFICANT SE = +1.2026151E+02
N = 162 DEGREES OF FREEDOM = 160
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH
PARAMETER = RELAXATION MODULUS
UNIT OF MEASURE = PSI
×10¹
0.00
40.00
80.00
120.00
160.00
200.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
AGE AT TEST (YEARS)
STRESS RELAXATION MODULUS, ANB-3066 (ANT P-POLYMER LINED), 10 SEC, 1% STRAIN

Figure 6-11



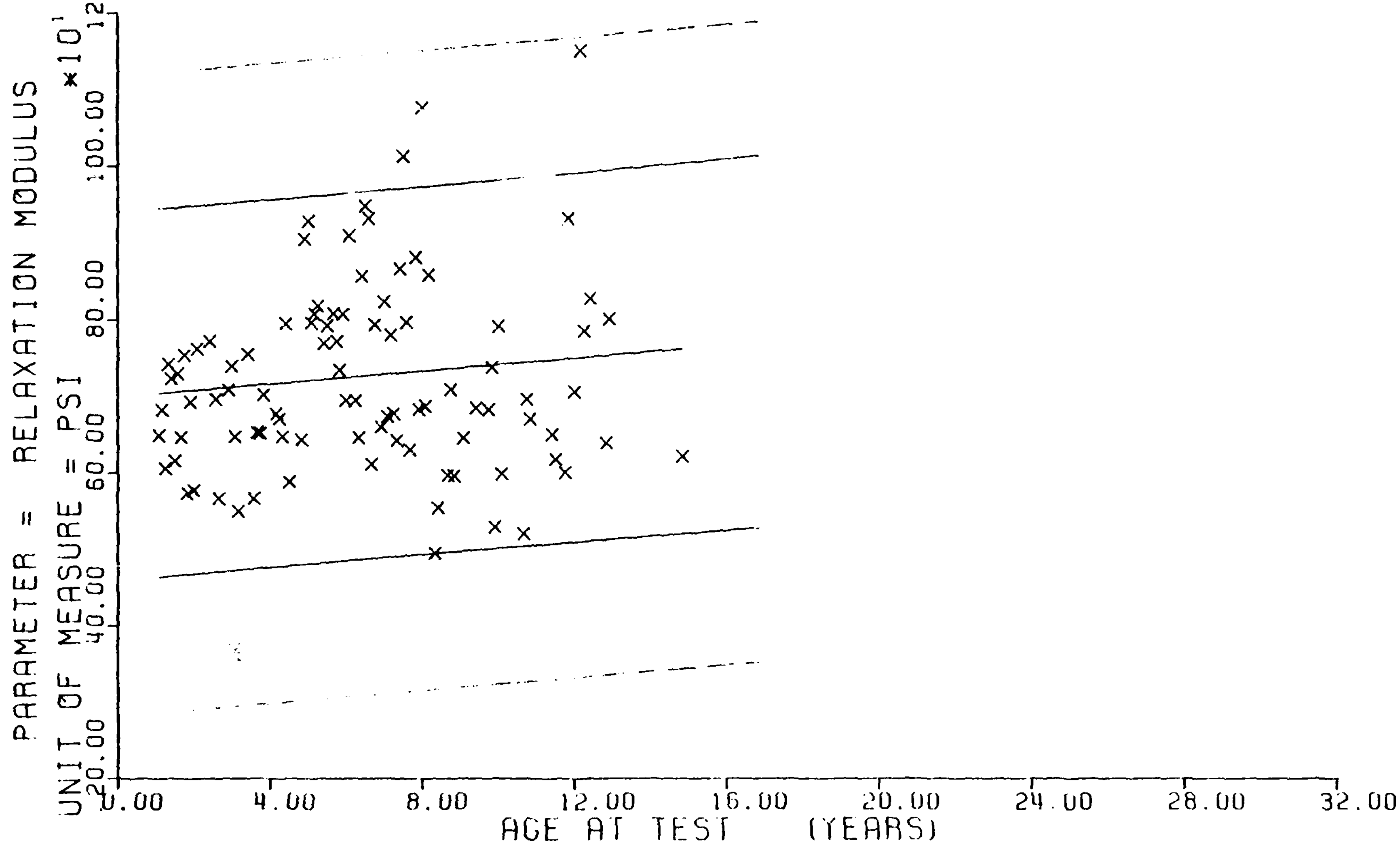
STRESS RELAXATION MODULUS. ANB-3066 (ANT P-POLYMER LINED). 1000 SEC. 1% STRAIN

Figure 6-12

Y = ((+6.9983718E+02) + (+3.4731681E-01) * X)

F = +4.4101544E+00 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_Y = +1.3995076E+02
R = +9.8951598E-02 SIGNIFICANCE OF R = SIGNIFICANT S_B = +1.6538606E-01
t = +2.1000367E+00 SIGNIFICANCE OF t = SIGNIFICANT S_E = +1.3941995E+02
N = 448 DEGREES OF FREEDOM = 446

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



STRESS RELAXATION MODULUS, ANB 3066 (ANB G-POLYMER UNLND), 10 SEC, 3% STRAIN

Figure 6-13

Y = ((+4.3133018E+02) + (-1.7261592E-01) * X)

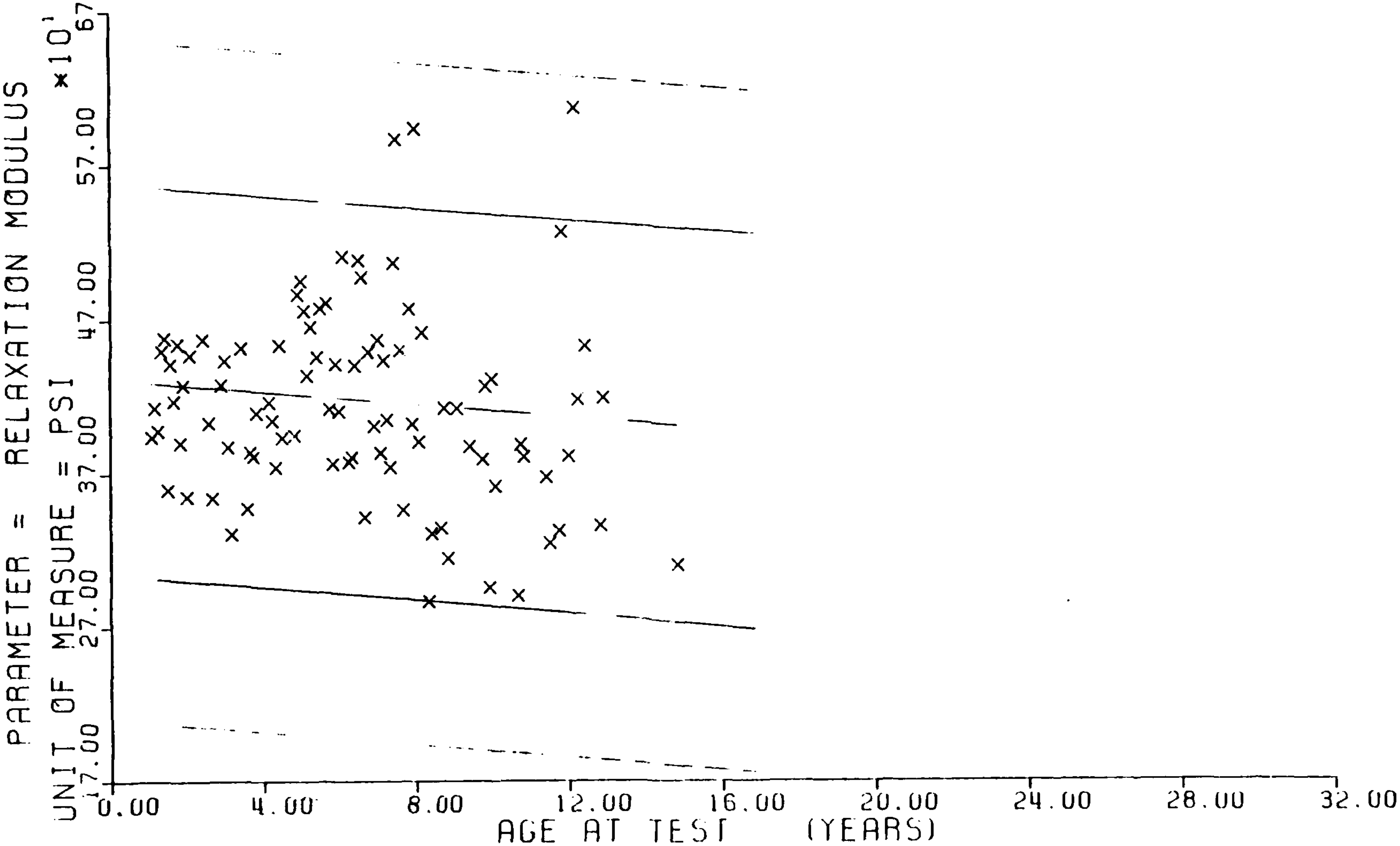
F = +3.9012794E+00 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_T = +7.3910853E+01

R = -9.3120417E-02 SIGNIFICANCE OF R = SIGNIFICANT S_B = +8.7393136E-02

t = +1.9751656E+00 SIGNIFICANCE OF t = SIGNIFICANT S_E = +7.3672153E+01

N = 448 DEGREES OF FREEDOM = 446

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



STRESS RELAXATION MODULUS, ANB-3066 (ANB G-POLYMER UNLND), 1000 SEC, 3% STRAIN

Figure 6-14

Y = ((+7.4393816E+02) + (+1.4507910E+00) * X)

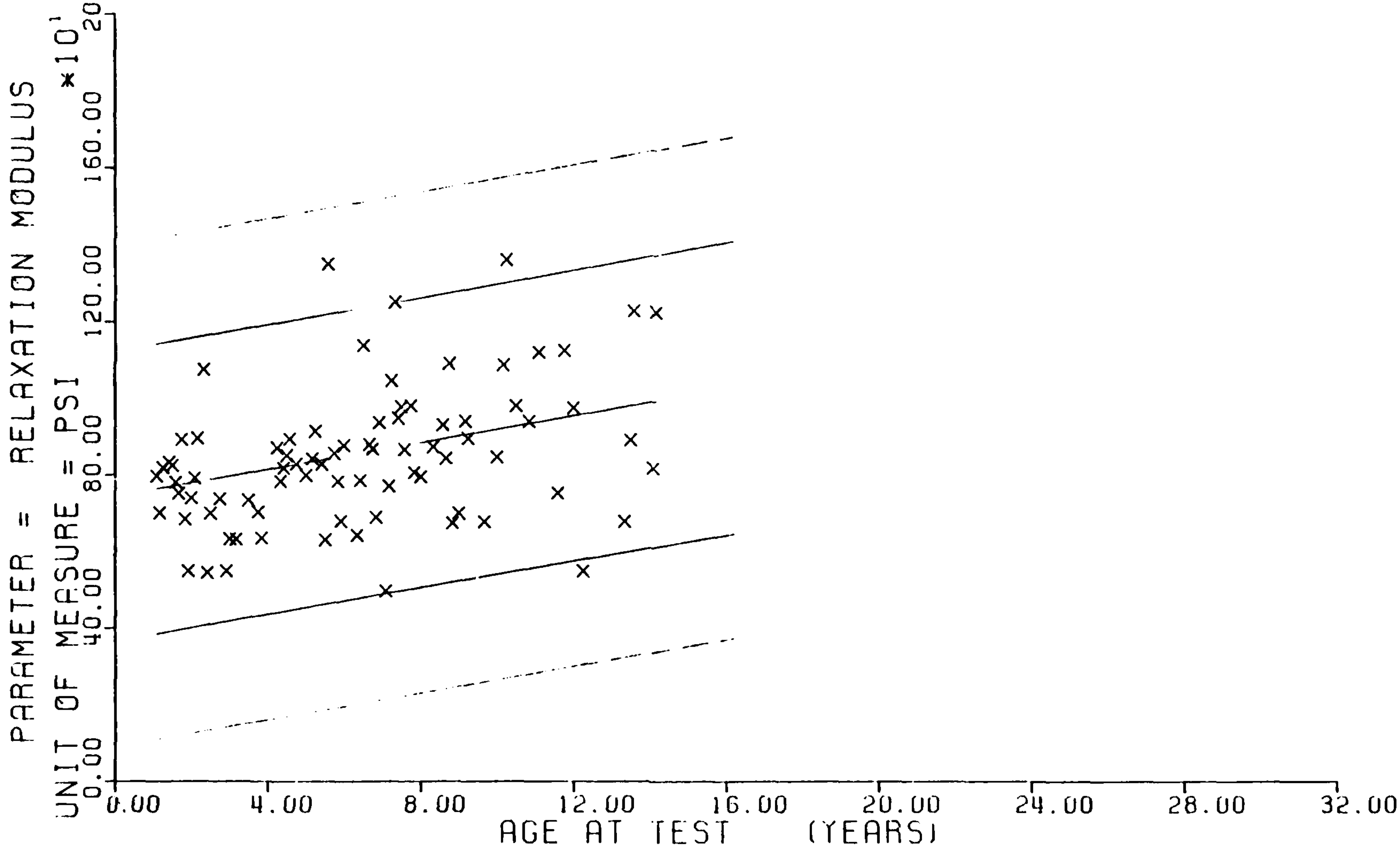
F = +2.9079415E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_T = +2.2624131E+02

R = +2.7480060E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +2.6903700E-01

t = +5.3925333E+00 SIGNIFICANCE OF t = SIGNIFICANT S_t = +2.1783661E+02

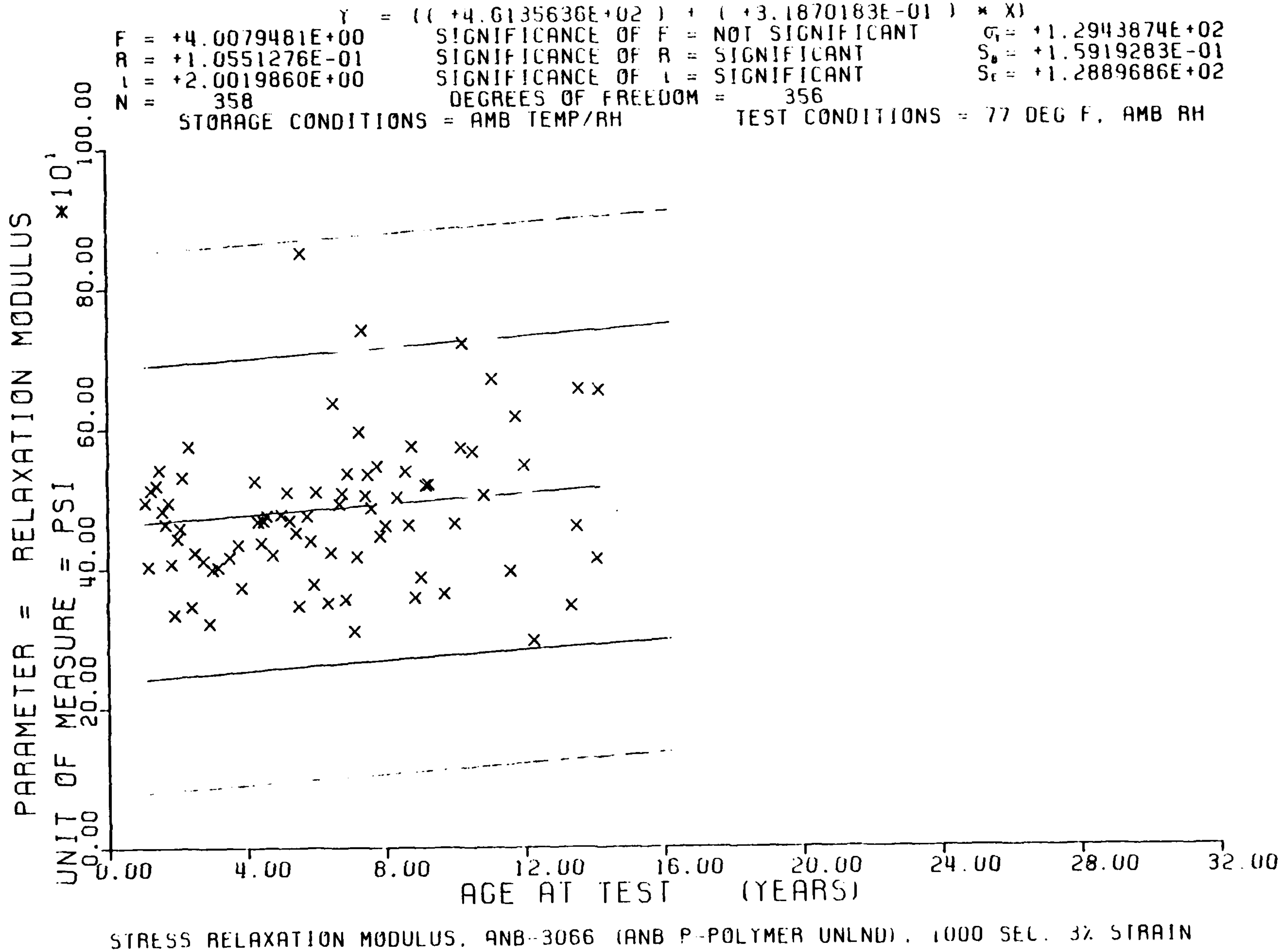
N = 358 DEGREES OF FREEDOM = 356

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



STRESS RELAXATION MODULUS, ANB-3066 (ANB P-POLYMER UNLND), 10 SEC, 3% STRAIN

Figure 6-15



Y = ((+4.6135636E+02) + (+3.1870183E-01) * X)
F = +4.0079481E+00 SIGNIFICANCE OF F = NOT SIGNIFICANT σ = +1.2943874E+02
R = +1.0551276E-01 SIGNIFICANCE OF R = SIGNIFICANT Sb = +1.5919283E-01
t = +2.0019860E+00 SIGNIFICANCE OF t = SIGNIFICANT St = +1.2889686E+02
N = 358 DEGREES OF FREEDOM = 356
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH
PARAMETER = RELAXATION MODULUS
UNIT OF MEASURE = PSI
*10¹
0.00
20.00
40.00
60.00
80.00
100.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
STRESS RELAXATION MODULUS, ANB-3066 (ANB P-POLYMER UNLND), 1000 SEC, 3% STRAIN

Figure 6-16

Y = ((+9.9511559E+02) + (-1.5259681E+00) * X)

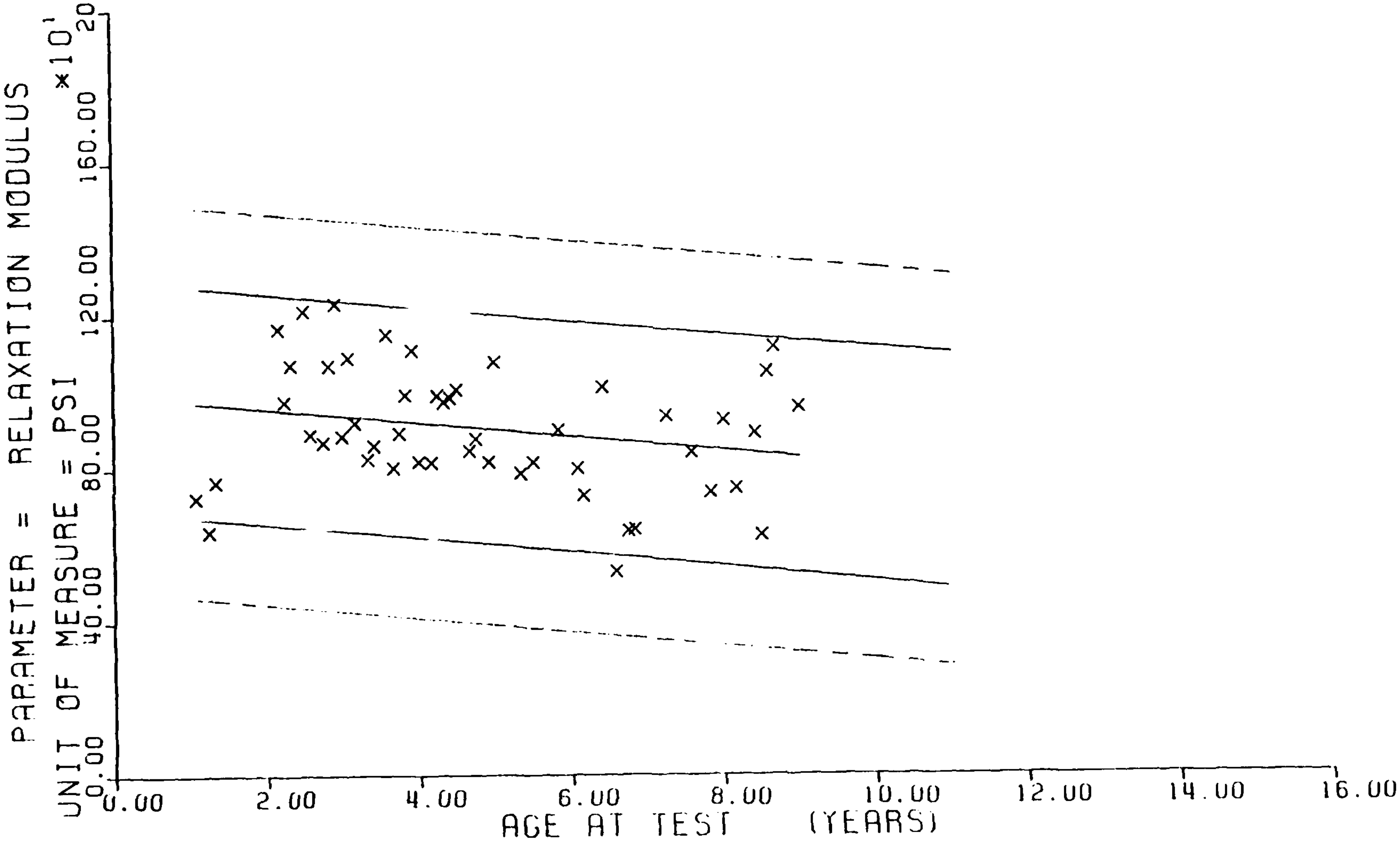
F = +1.0600021E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_T = +1.7395824E+02

R = -2.1724434E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +4.6869693E-01

t = +3.2557673E+00 SIGNIFICANCE OF t = SIGNIFICANT S_t = +1.7019991E+02

N = 216 DEGREES OF FREEDOM = 214

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH

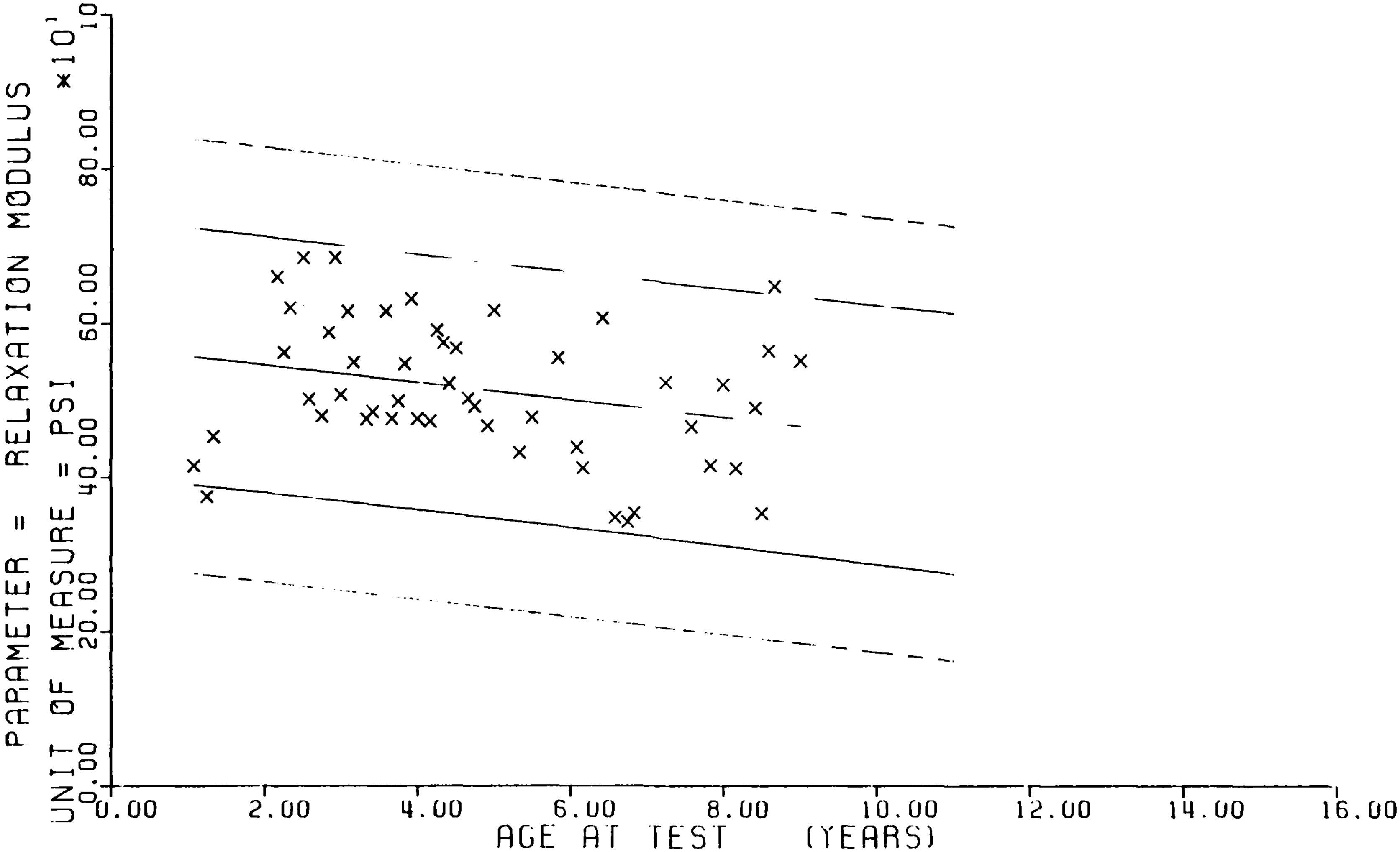


STRESS RELAXATION MODULUS, ANB-3066 (ANT P-POLYMER UNLND), 10 SEC, 3% STRAIN

Figure 6-17

Y = ((+5.6926435E+02) + (-9.5366622E-01) × X)

F = +1.3627731E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +9.6546442E+01
R = -2.4468041E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +2.5838998E-01
t = +3.6915757E+00 SIGNIFICANCE OF t = SIGNIFICANT S_E = +9.3830259E+01
N = 216 DEGREES OF FREEDOM = 214
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



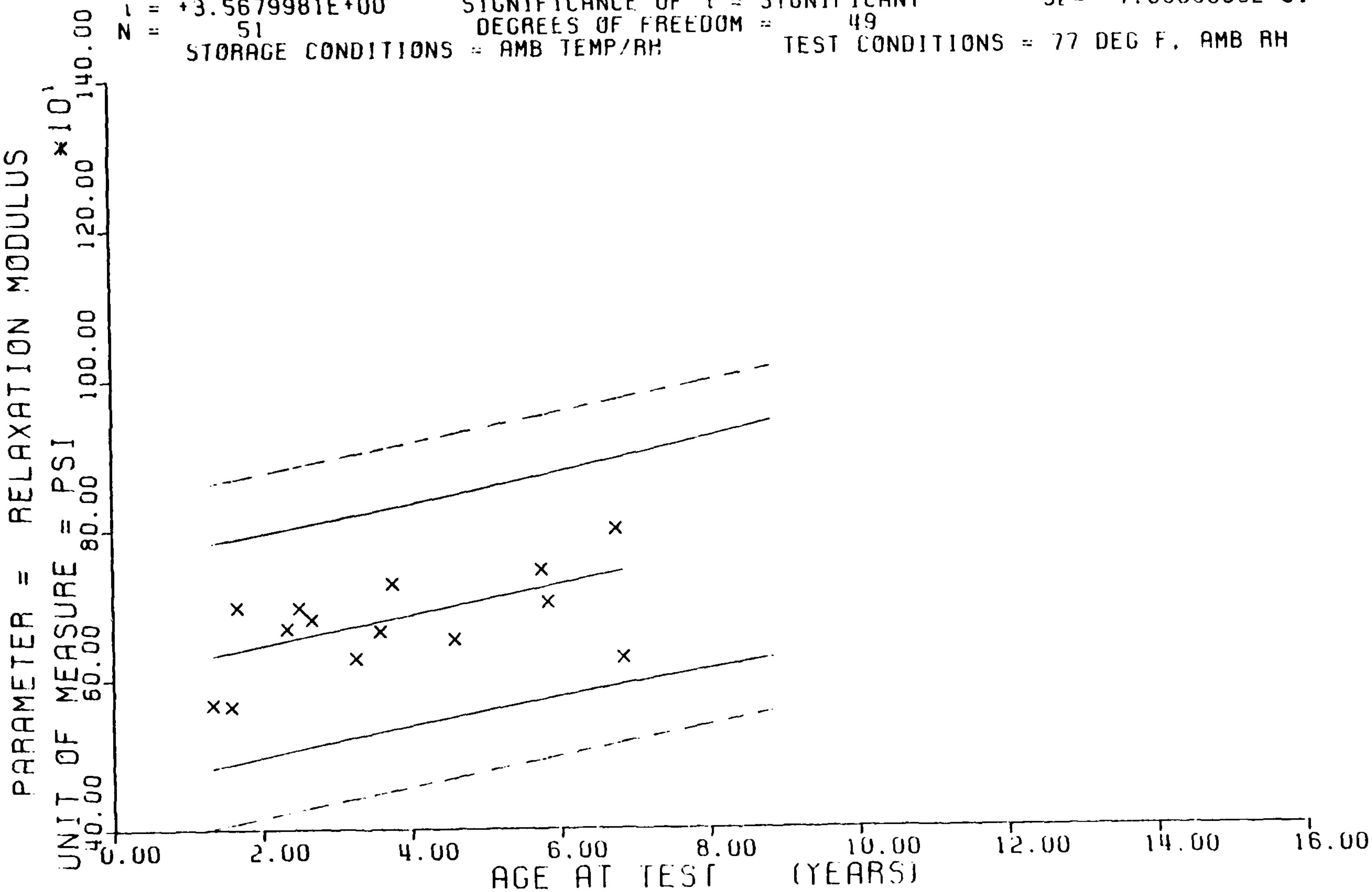
STRESS RELAXATION MODULUS, ANB-3066 (ANT P-POLYMER UNLND), 1000 SEC, 3% STRAIN

Figure 6-18

Y = ((+6.0475211E+02) + (+1.6973272E+00) * X)

F = +1.2730610E+01	SIGNIFICANCE OF F = SIGNIFICANT		σ_t = +8.5101176E+01
R = +4.5412387E-01	SIGNIFICANCE OF R = SIGNIFICANT		S_b = +4.7570854E-01
t = +3.5679981E+00	SIGNIFICANCE OF t = SIGNIFICANT		S_t = +7.6589683E+01
N = 51	DEGREES OF FREEDOM = 49		

STORAGE CONDITIONS = AMB TEMP/RH   TEST CONDITIONS = 77 DEG F, AMB RH



STRESS RELAXATION MODULUS, ANB-3066 (ANB G-POLYMER LINED), 10 SEC, 3% STRAIN

Figure 6-19

Y = ((+3.7129628E+02) + (+1.0351083E+00) * X)

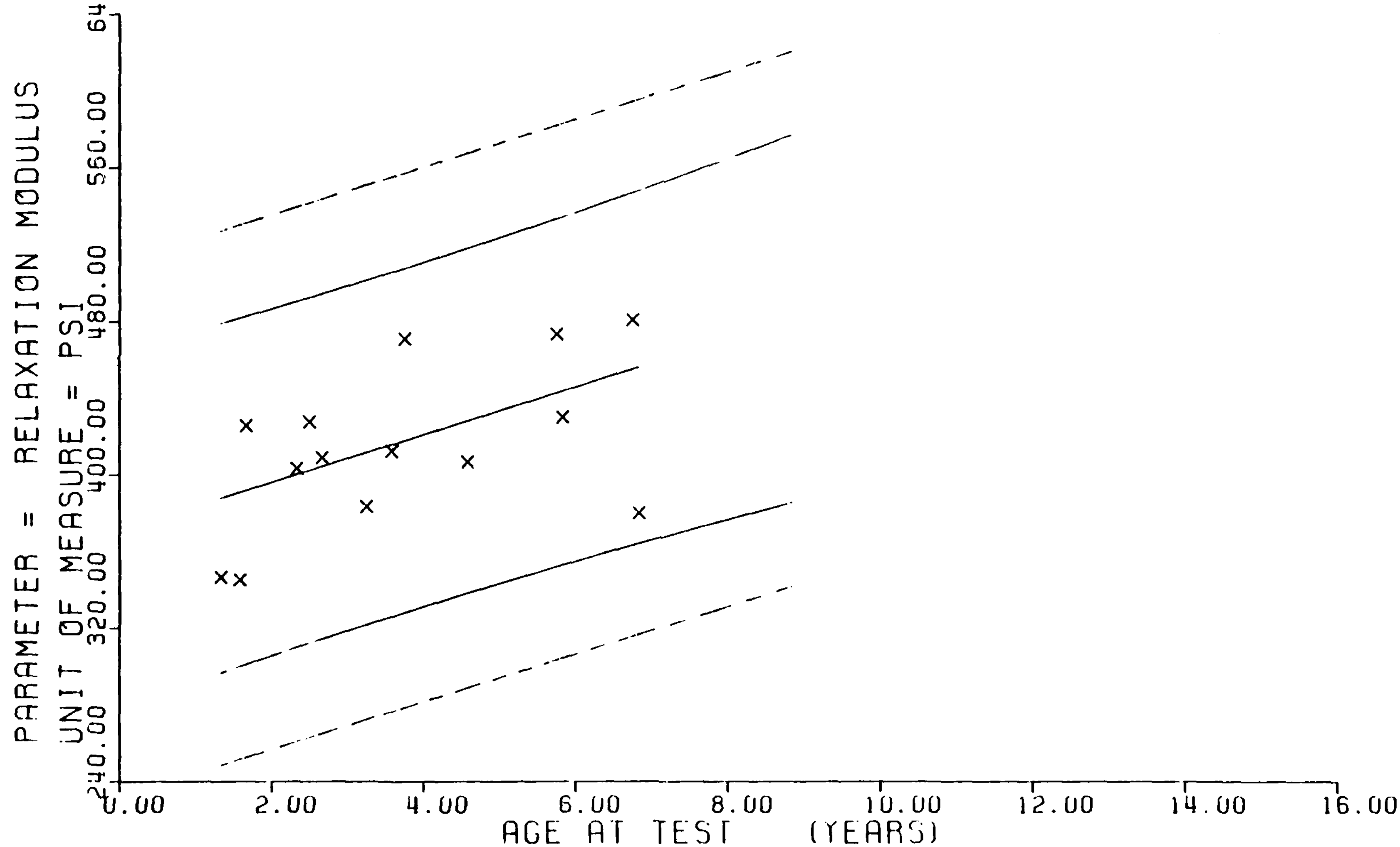
F = +1.2858415E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_1 = +5.1693465E+01

R = +4.5592596E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +2.8866305E-01

t = +3.5858632E+00 SIGNIFICANCE OF t = SIGNIFICANT S_t = +4.0475216E+01

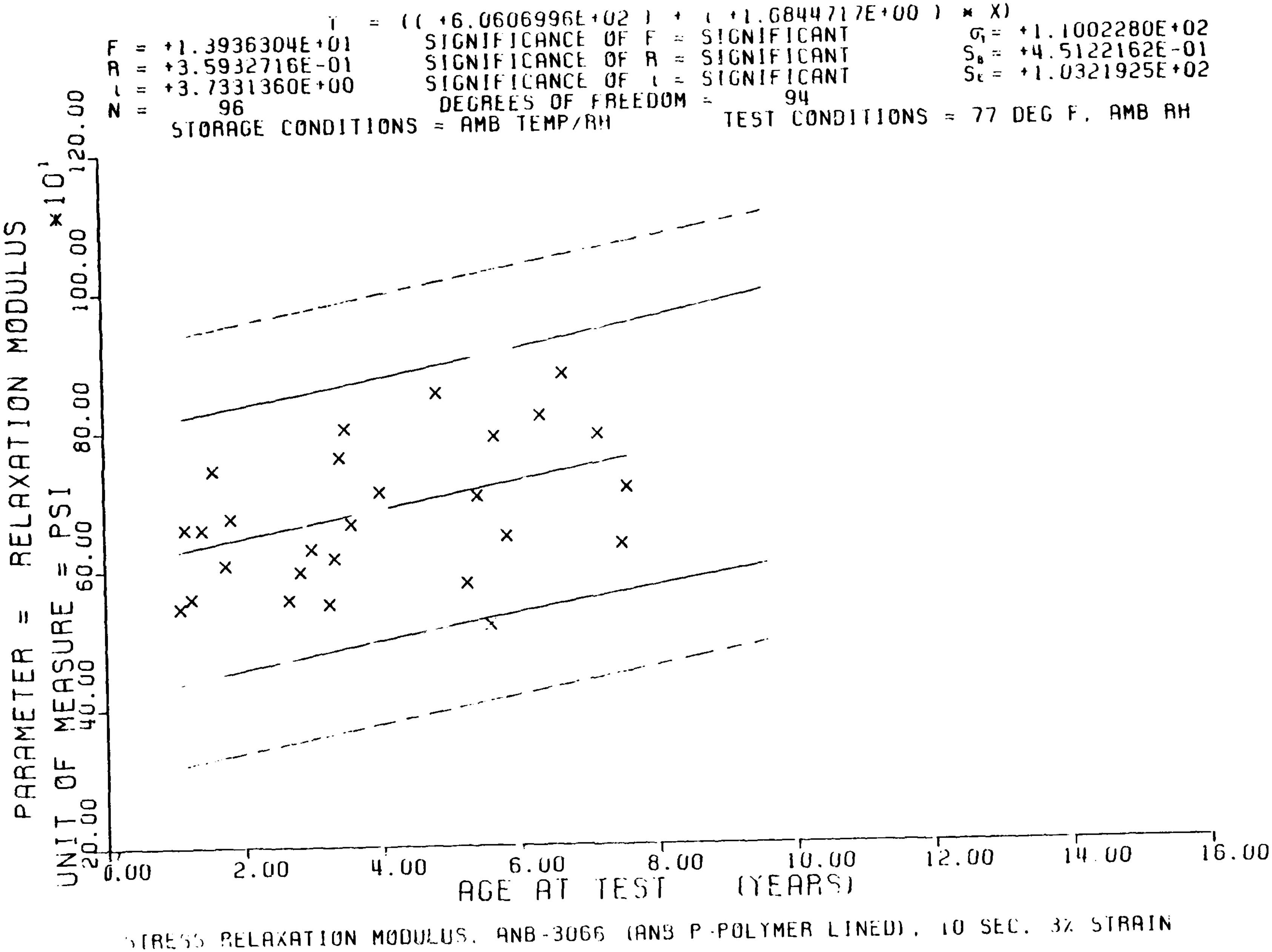
N = 51 DEGREES OF FREEDOM = 49

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F. AMB RH



STRESS RELAXATION MODULUS. 9NB-3066 (ANB G-POLYMER LINED). 1000 SEC. 3% STRAIN

Figure 6-20



Y = ((+6.0606996E+02) + (+1.6844717E+00) * X)
F = +1.3936304E+01 SIGNIFICANCE OF F = SIGNIFICANT
R = +3.5932716E-01 SIGNIFICANCE OF R = SIGNIFICANT
t = +3.7331360E+00 SIGNIFICANCE OF t = SIGNIFICANT
N = 96 DEGREES OF FREEDOM = 94
STORAGE CONDITIONS = AMB TEMP/RH
TEST CONDITIONS = 77 DEG F, AMB RH
σ1 = +1.1002280E+02
Sb = +4.5122162E-01
Se = +1.0321925E+02
PARAMETER = RELAXATION MODULUS
UNIT OF MEASURE = PSI
×10¹
20.00
40.00
60.00
80.00
100.00
120.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
AGE AT TEST (YEARS)
STRESS RELAXATION MODULUS, ANB-3066 (ANB P-POLYMER LINED), 10 SEC, 3% STRAIN

Figure 6-21

Y = ((+3.7620521E+02) + (+7.9425568E-01) * X)

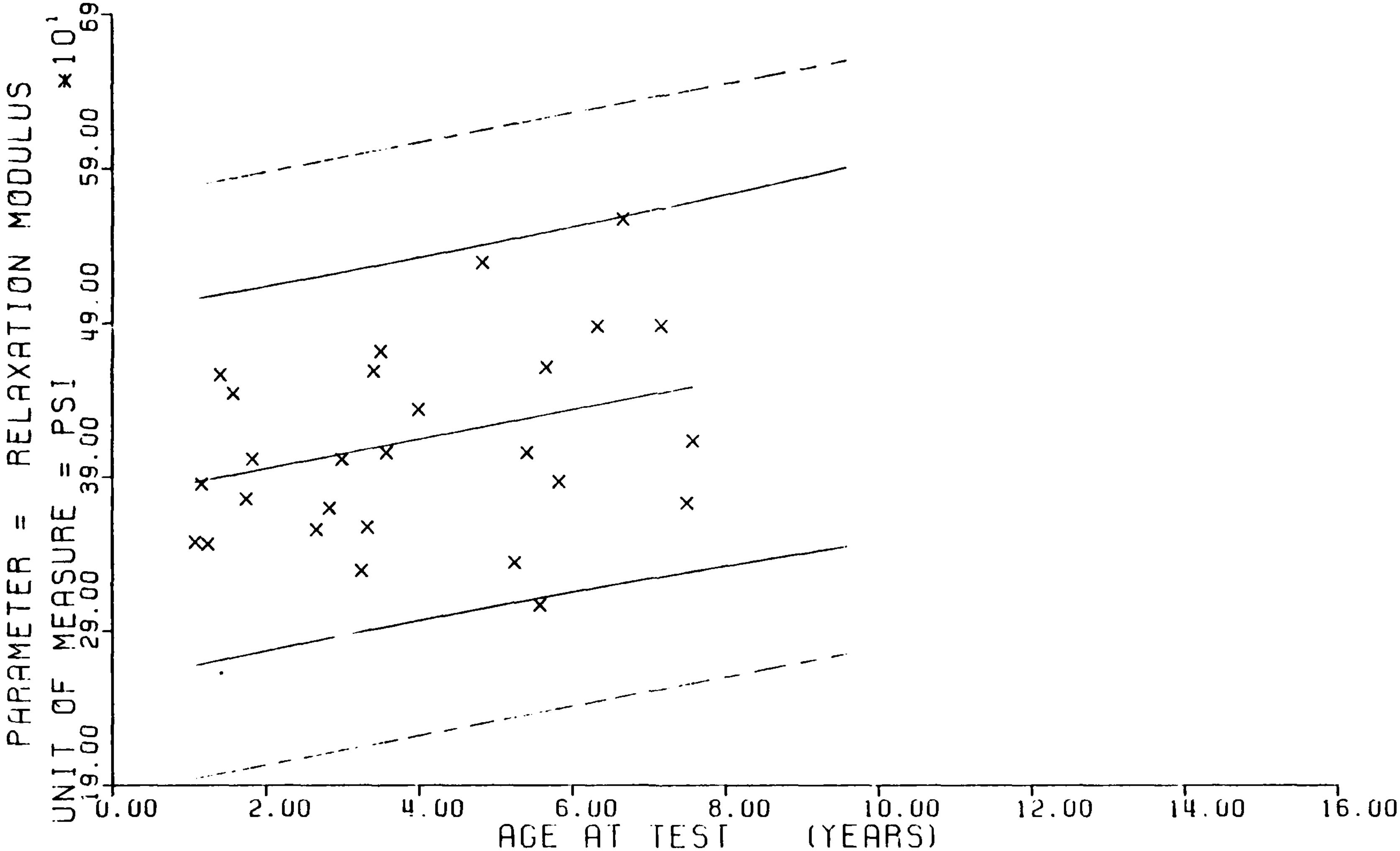
F = +8.0255693E+00 SIGNIFICANCE OF F = SIGNIFICANT σ_T = +6.6463918E+01

R = +2.8046806E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +2.8036410E-01

t = +2.8329435E+00 SIGNIFICANCE OF t = SIGNIFICANT S_E = +6.4134724E+01

N = 96 DEGREES OF FREEDOM = 94

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH

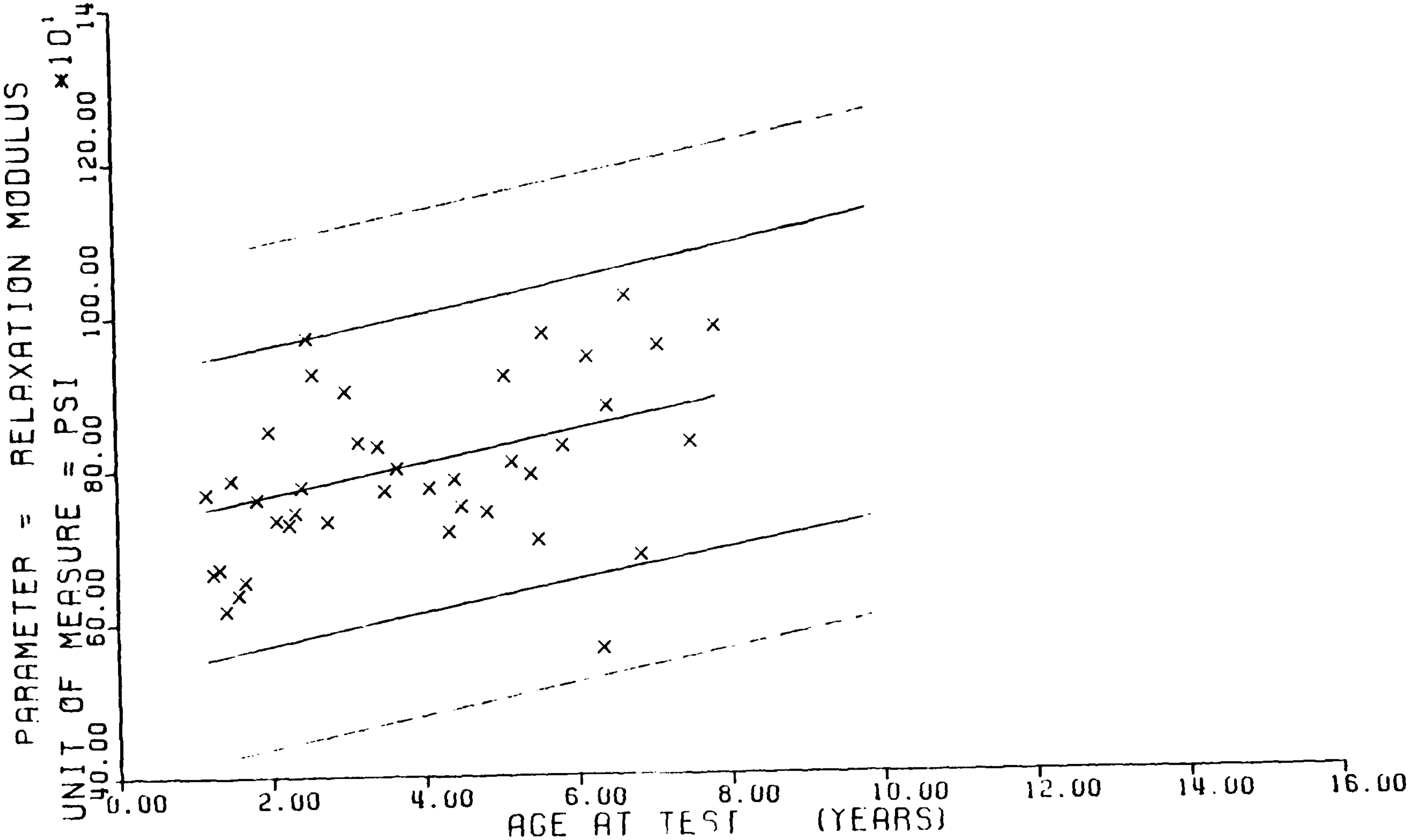


STRESS RELAXATION MODULUS, ANB-3066 (ANB P-POLYMER LINED), 1000 SEC, 3% STRAIN

Figure 6-22

Y = ((+7.2455703E+02) + (+1.7505574E+00) * X)

F = +2.4900825E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_1 = +1.1681889E+02
R = +3.4775855E-01 SIGNIFICANCE OF R = SIGNIFICANT S_a = +3.5080800E-01
t = +4.9900726E+00 SIGNIFICANCE OF t = SIGNIFICANT S_t = +1.0982968E+02
N = 183 DEGREES OF FREEDOM = 181
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F. AMB RH



STRESS RELAXATION MODULUS, ANB-3066 (ANT P-POLYMER LINED), 10 SEC, 3% STRAIN

Figure 6-23

Y = ((+4.1226727E+02) + (+1.3379163E+00) * X)

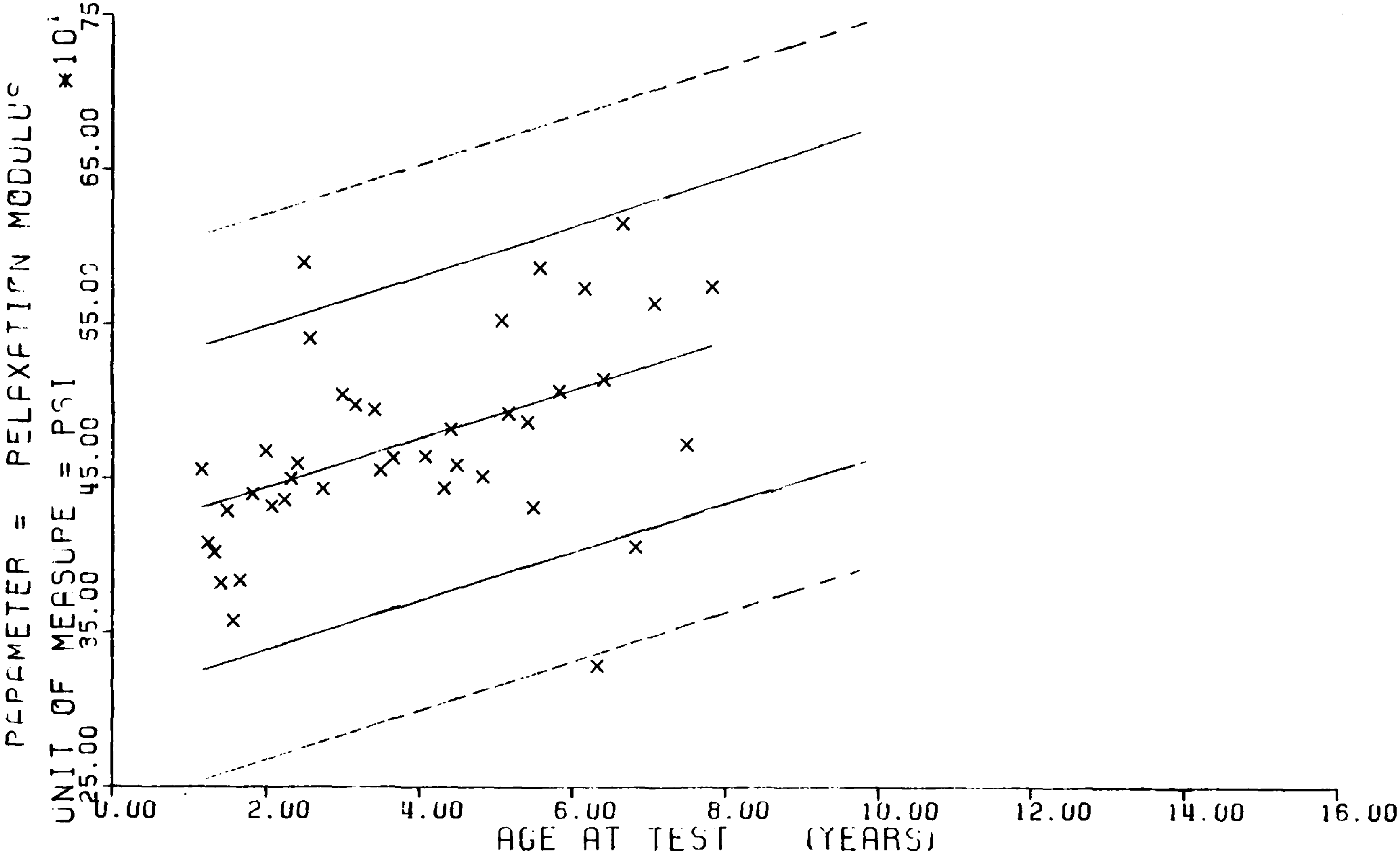
F = +4.9712555E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_i = +6.6387733E+01

R = +4.6419176E-01 SIGNIFICANCE OF R = SIGNIFICANT S_b = +1.8823788E-01

t = +7.0507131E+00 SIGNIFICANCE OF t = SIGNIFICANT S_E = +5.8964133E+01

N = 183 DEGREES OF FREEDOM = 181

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



STRESS RELAXATION MODULUS, ANB-3066 (ANT P-POLYMER LINED), 1000 SEC, 3% STRAIN

Figure 6-24

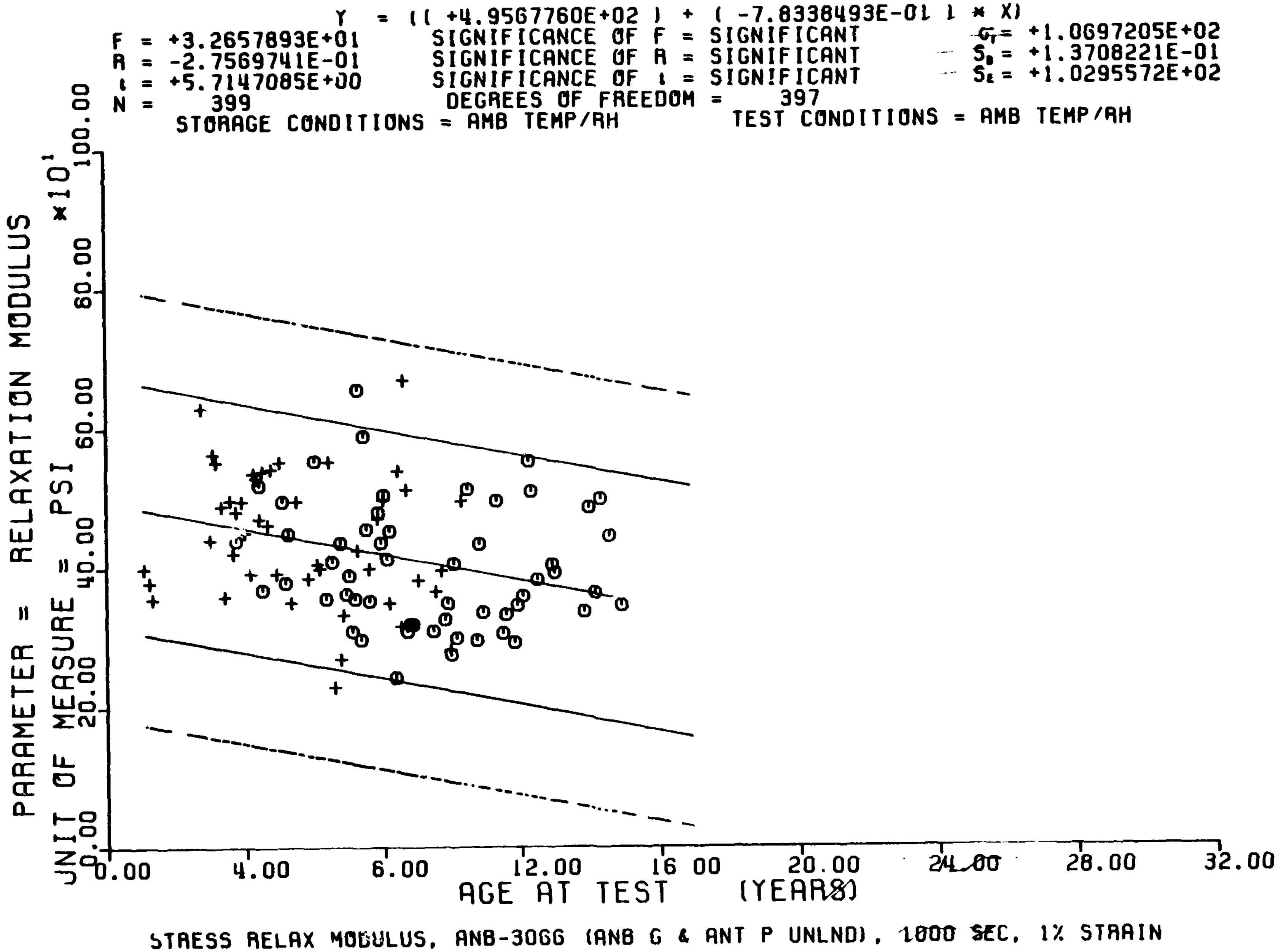
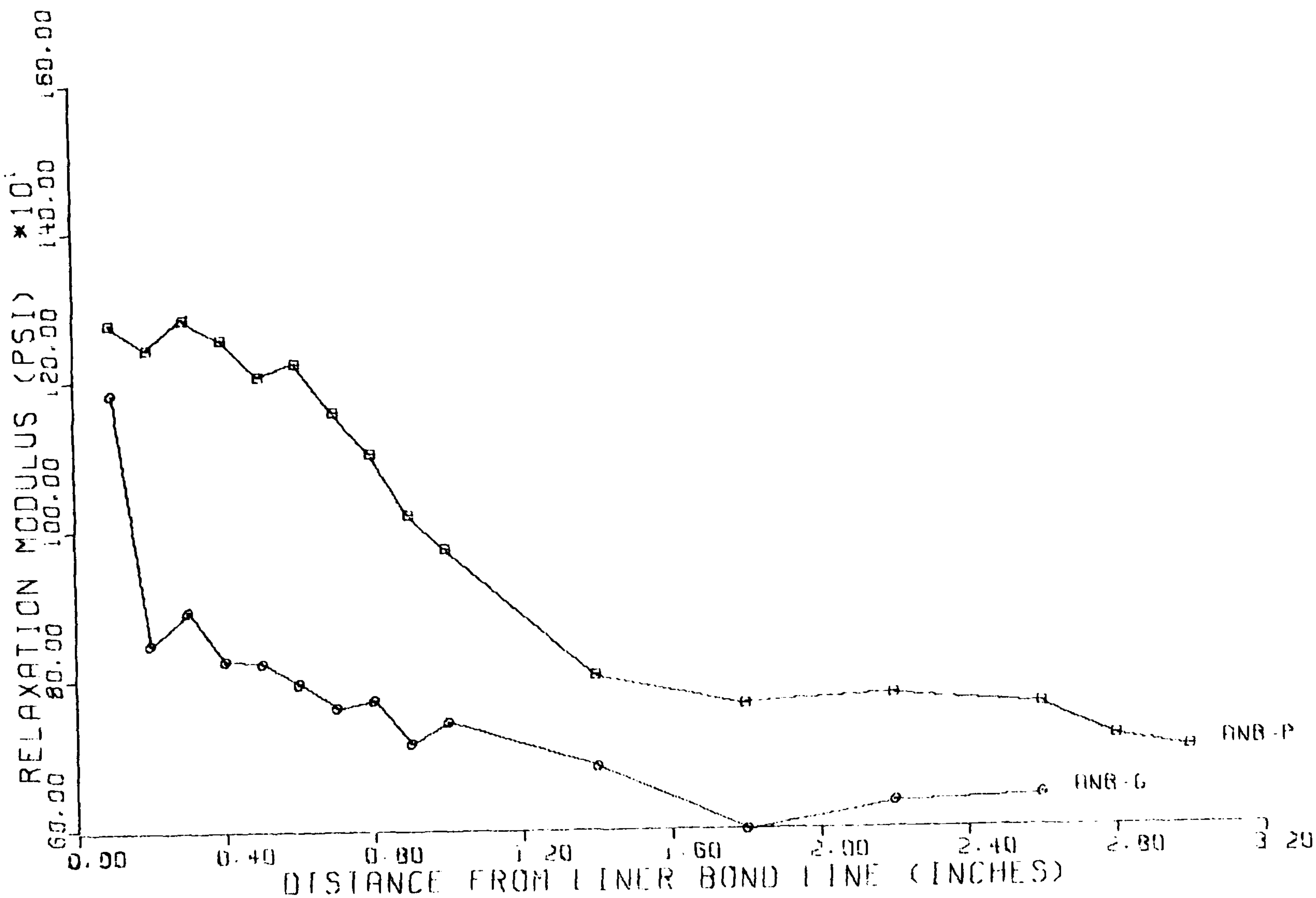
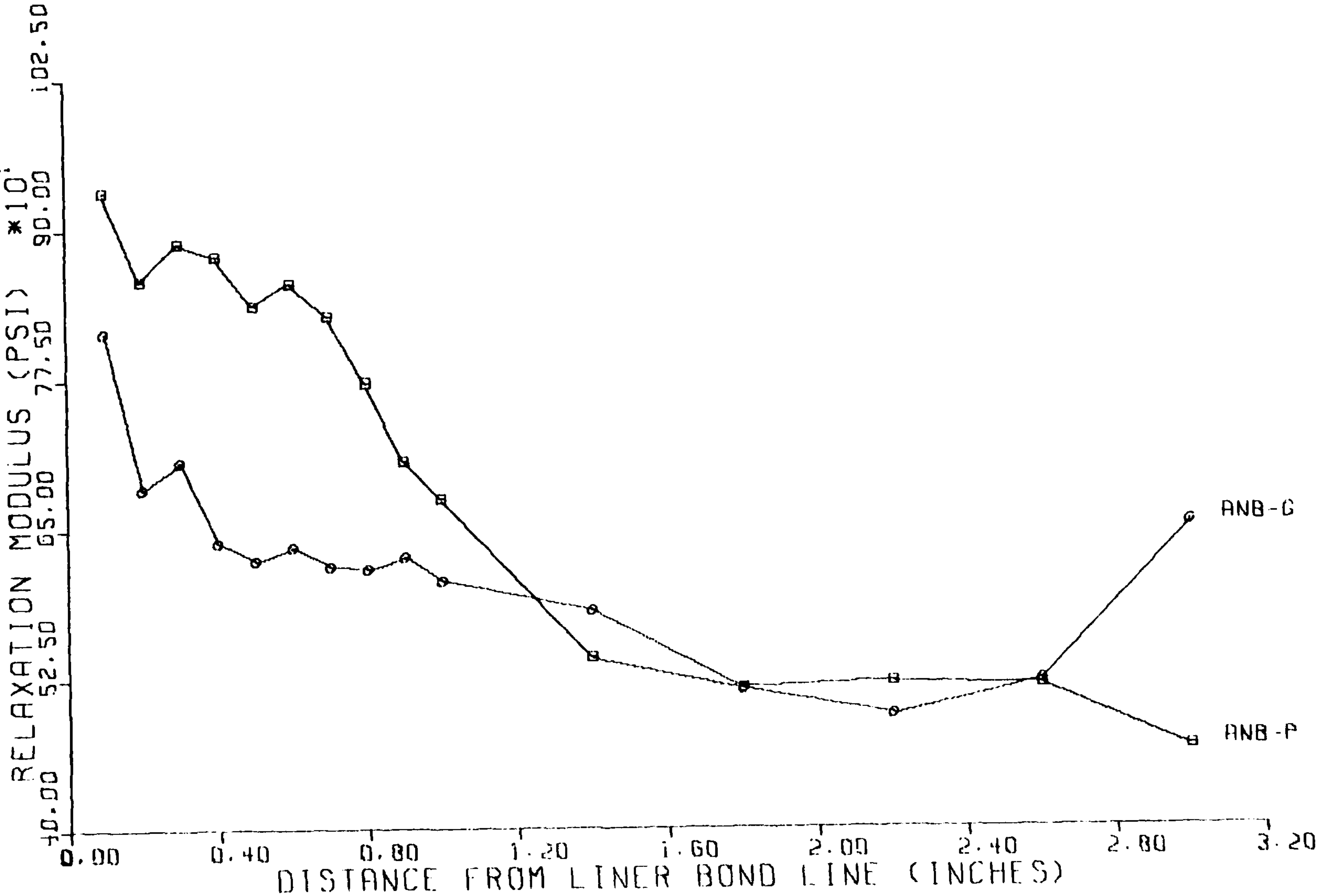

Y = ((+4.9567760E+02) + (-7.8338493E-01) * X)
F = +3.2657893E+01 SIGNIFICANCE OF F = SIGNIFICANT
R = -2.7569741E-01 SIGNIFICANCE OF R = SIGNIFICANT
t = +5.7147085E+00 SIGNIFICANCE OF t = SIGNIFICANT
N = 399 DEGREES OF FREEDOM = 397
σT = +1.0697205E+02
Sb = +1.3708221E-01
Sε = +1.0295572E+02
STORAGE CONDITIONS = AMB TEMP/RH
TEST CONDITIONS = AMB TEMP/RH
PARAMETER = RELAXATION MODULUS
UNIT OF MEASURE = PSI
×10¹
0.00
20.00
40.00
60.00
80.00
100.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
STRESS RELAX MODULUS, ANB-3066 (ANB G & ANT P UNLND), 1000 SEC, 1% STRAIN

Figure 6-25



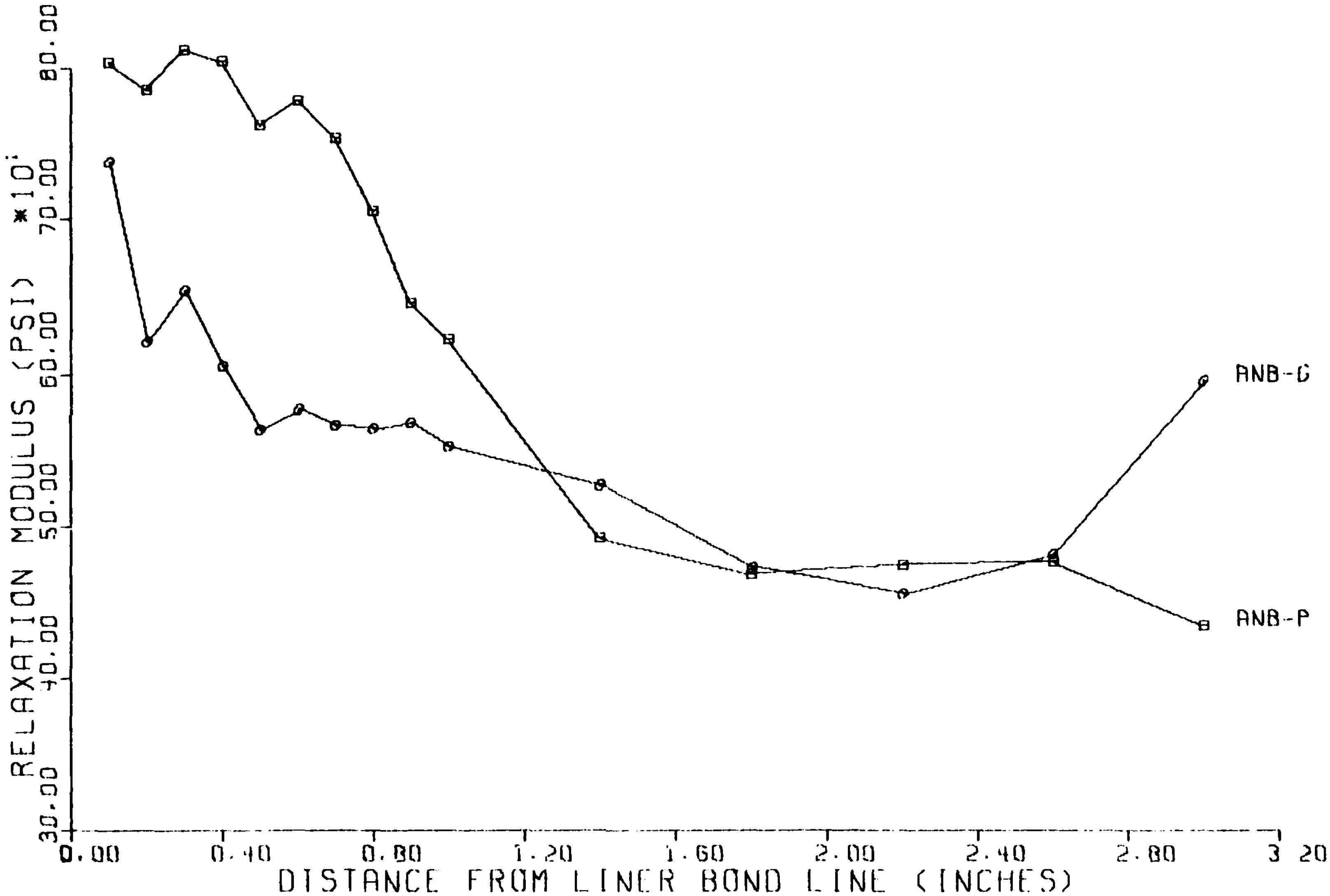
ANB-P AND ANB-G GRADIENT STRESS RELAXATION MODULUS AT 3% STRAIN AND 6 SECONDS

Figure 6-26



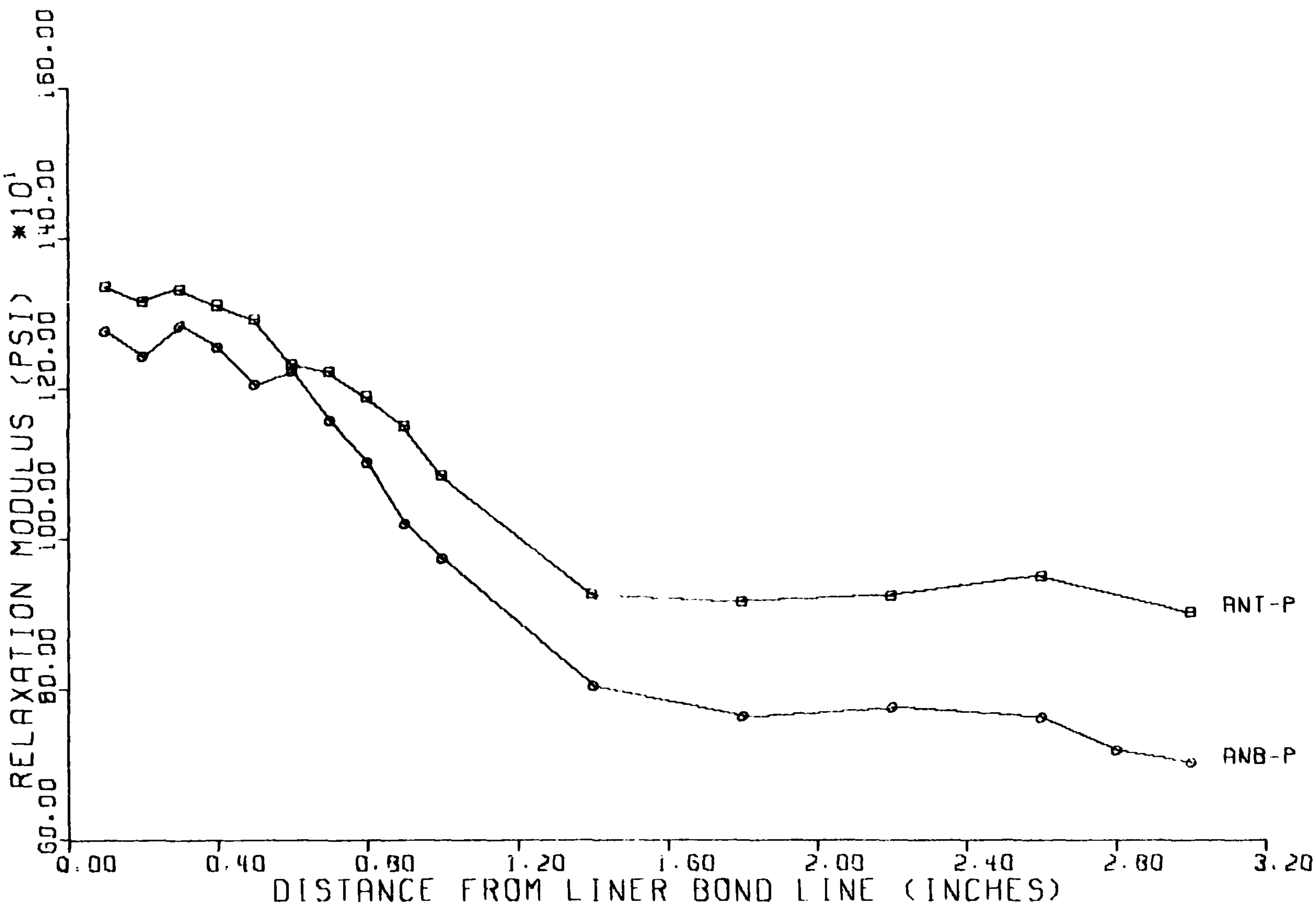
ANB-P AND ANB-G GRADIENT STRESS RELAXATION MODULUS AT 3% STRAIN AND 60 SECONDS

Figure 6-27



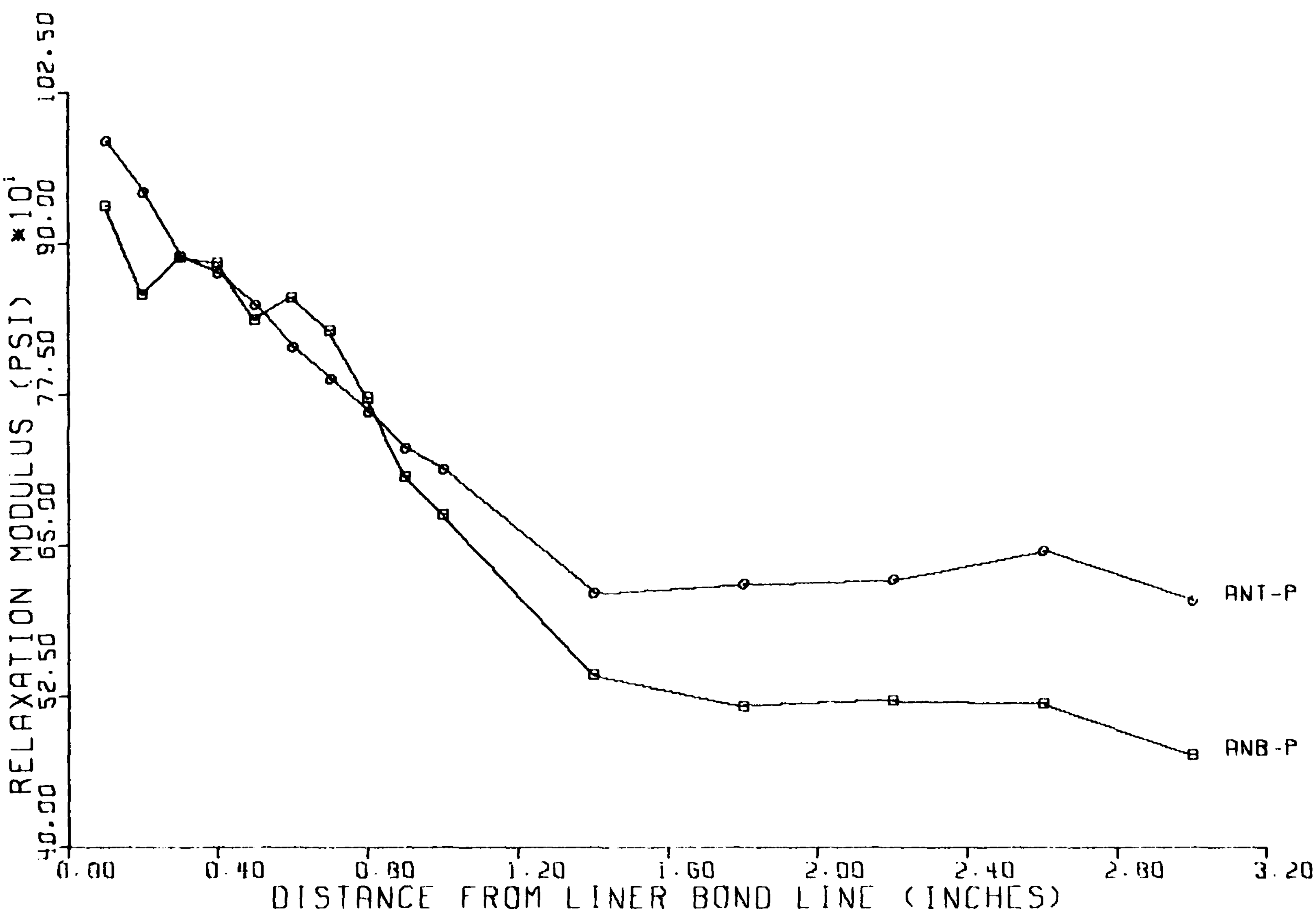
ANB-P AND ANB-G GRADIENT STRESS RELAXATION MODULUS AT 3% STRAIN AND 100 SECONDS

Figure 6-28



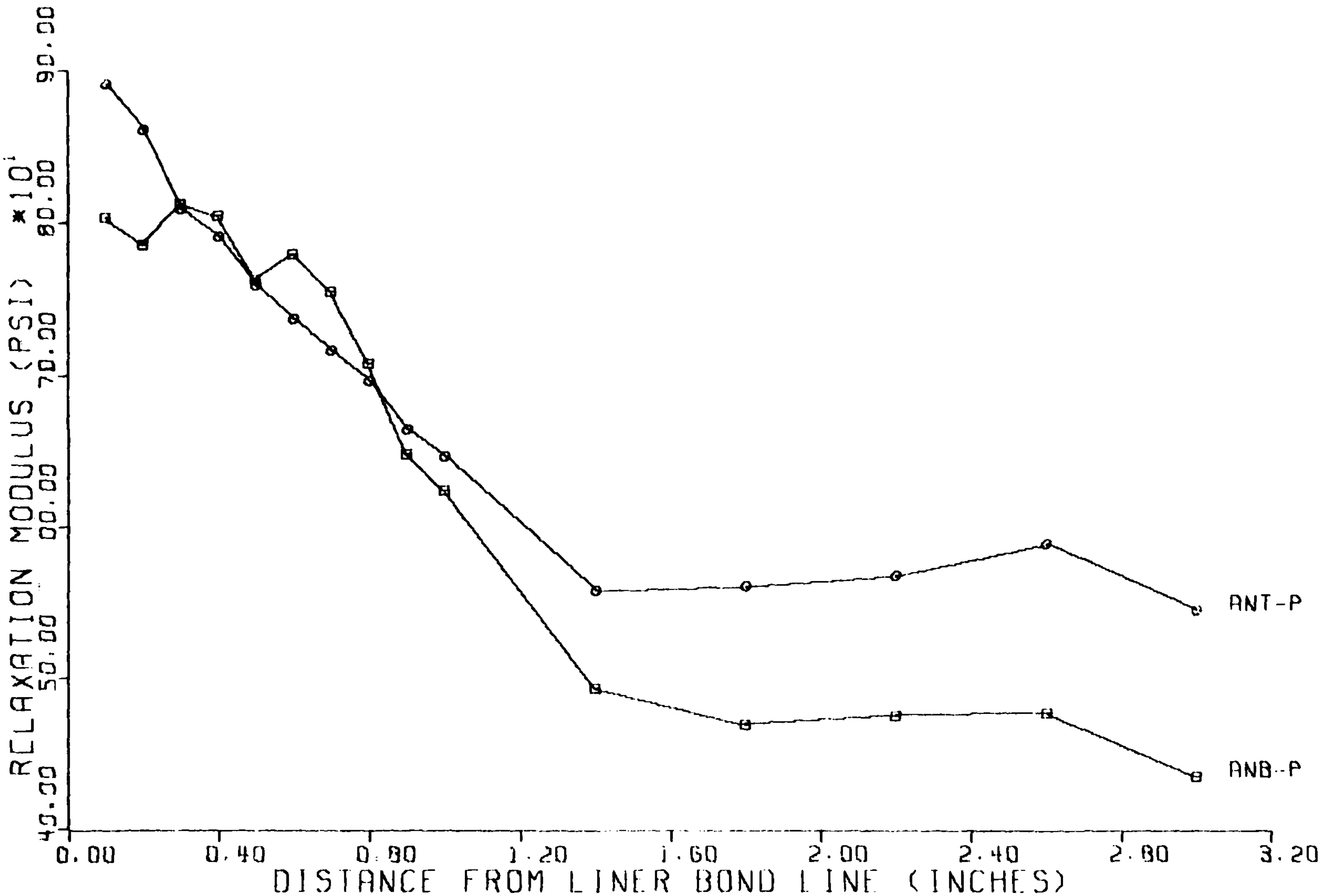
ANB-P AND ANT-P GRADIENT STRESS RELAXATION MODULUS AT 3% STRAIN AND 6 SECONDS

Figure 6-29



ANB-P AND ANT-P GRADIENT STRESS RELAXATION MODULUS AT 3% STRAIN AND 60 SECONDS

Figure 6-30



ANB-P AND ANT-P GRADIENT STRESS RELAXATION MODULUS AT 3% STRAIN AND 100 SECONDS

Figure 6-31

TABLE 6-4

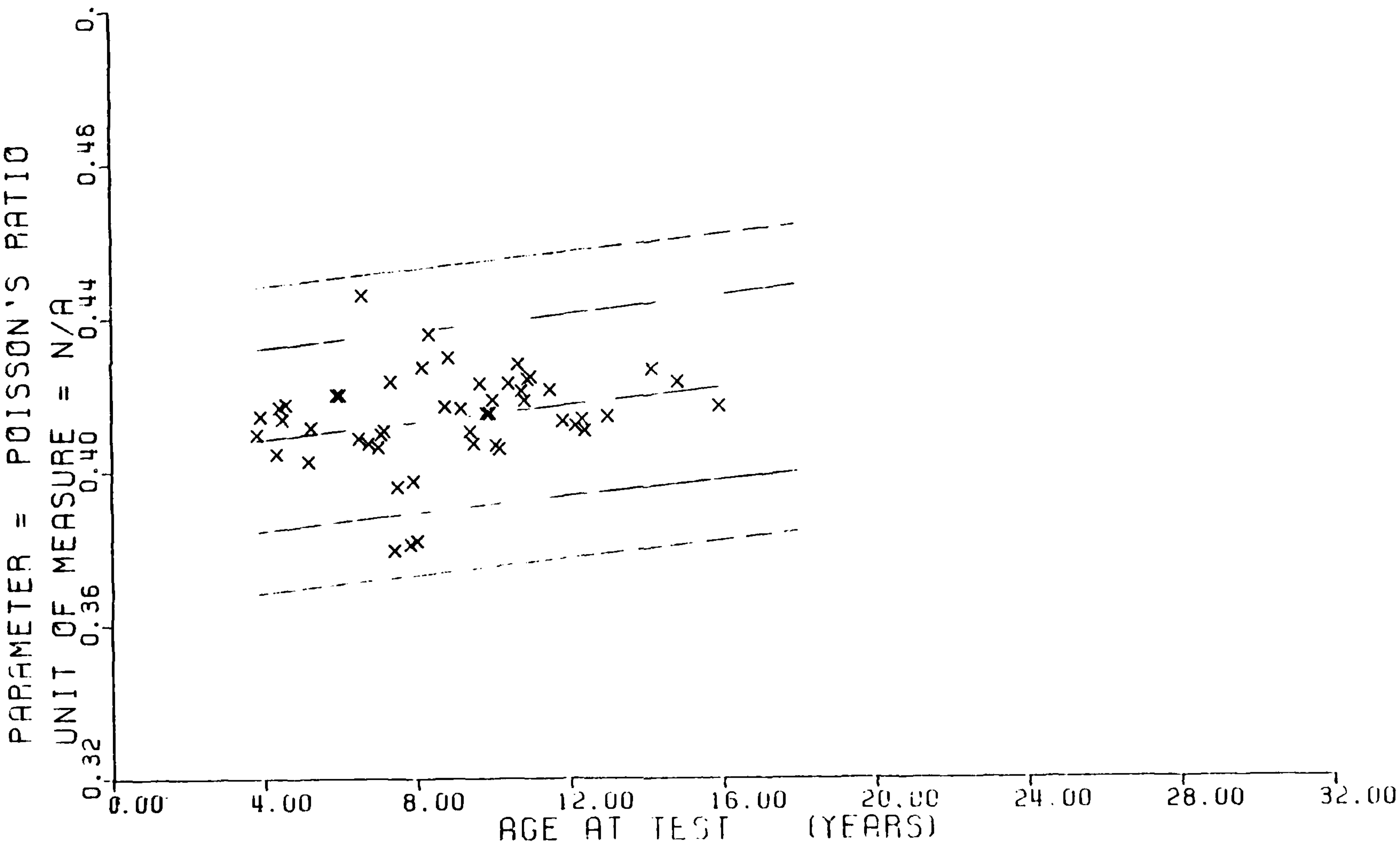
ANALYSIS OF COVARIANCE COMPARISON OF REGRESSIONS
FOR STRAIN DILATATION TESTING

		Dilatation at Max Strain	Poisson's Ratio at Max Strain	Poisson's Ratio at 15% Strain
Lined Vs Unlined				
ANB P-polymer	Residual Variance	S	S	S
	Slope	NS	NS	NS
	Elevation	S	NS	S
ANB G-polymer	Residual Variance	S	S	S
	Slope	S	NS	S
	Elevation	S	NS	S
ANT P-polymer	Residual Variance	S	S	S
	Slope	S	S	NS
	Elevation	S	NS	NS
ANB P Unlnd Vs ANT P Lined	Residual Variance	S	S	S
	Slope	S	S	S
	Elevation	NS	NS	NS
G-polymer Vs P-polymer				
ANB Lined	Residual Variance	S	S	NS
	Slope	NS	NS	S
	Elevation	NS	NS	NS
ANB Unlined	Residual Variance	S	S	NS
	Slope	NS	NS	S
	Elevation	S	S	S
ANB G Unlnd Vs ANT P Unlnd	Residual Variance	S	S	S
	Slope	NS	S	S
	Elevation	S	S	S
ANB G Lined Vs ANT P Lined	Residual Variance	S	S	NS
	Slope	NS	NS	S
	Elevation	NS	S	NS
ANB P-polymer Vs ANT P-polymer				
Lined	Residual Variance	NS	S	S
	Slope	S	NS	NS
	Elevation	NS	S	S
Unlined	Residual Variance	NS	NS	S
	Slope	NS	S	S
	Elevation	NS	S	NS

Y = ((+4.0393138E-01) + (+9.4011554E-05) * X)

F = +9.9999046E+00	SIGNIFICANCE OF F = SIGNIFICANT		σ_Y = +1.3652228E-02
R = +2.3249422E-01	SIGNIFICANCE OF R = SIGNIFICANT		S_B = +2.9729205E-05
t = +3.1622625E+00	SIGNIFICANCE OF t = SIGNIFICANT		S_t = +1.3316010E-02
N = 177	DEGREES OF FREEDOM = 175		

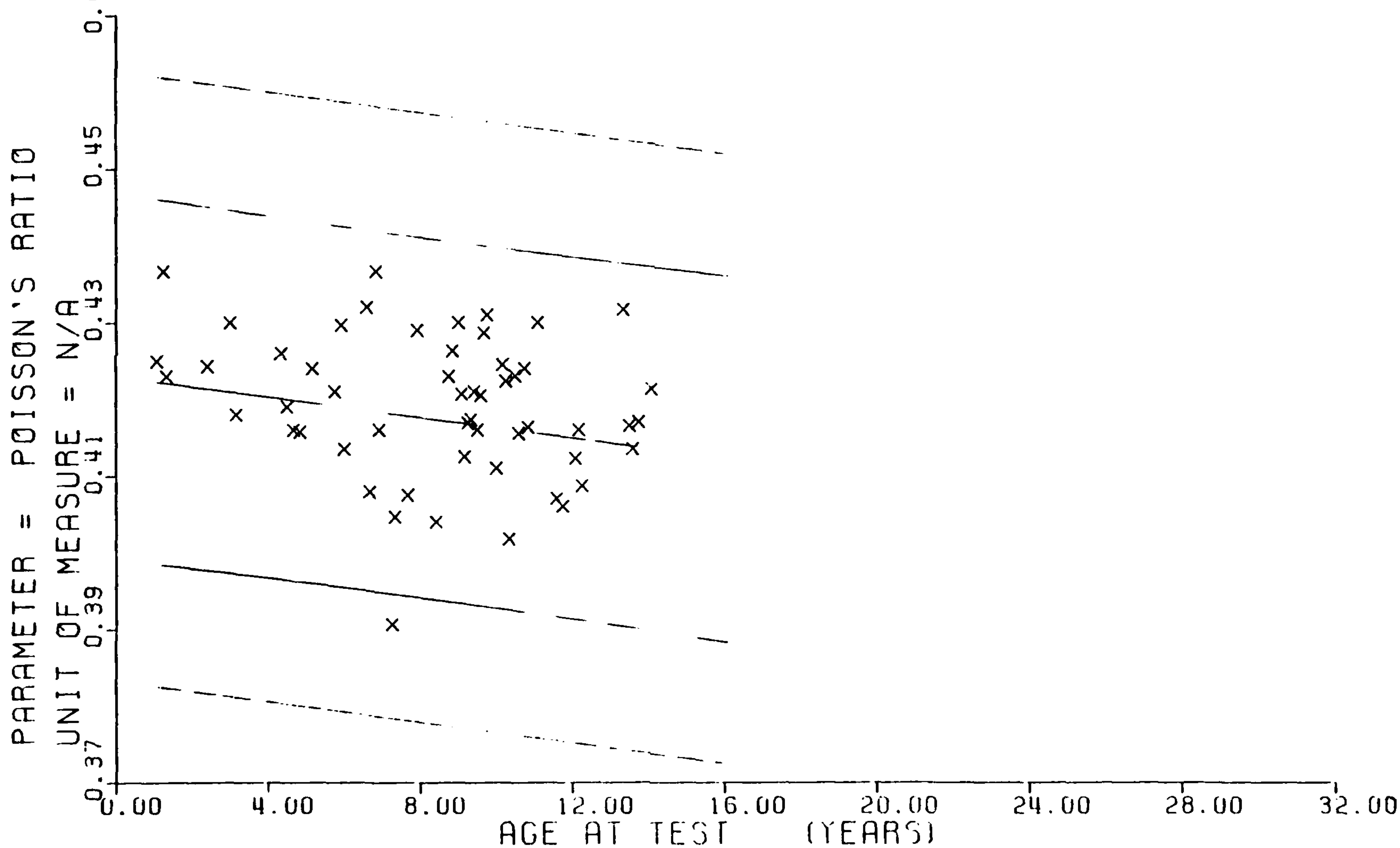
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



POISSON'S RATIO AT 15% STRAIN, ANB-3066 (ANB G-POLYMER UNLINED)

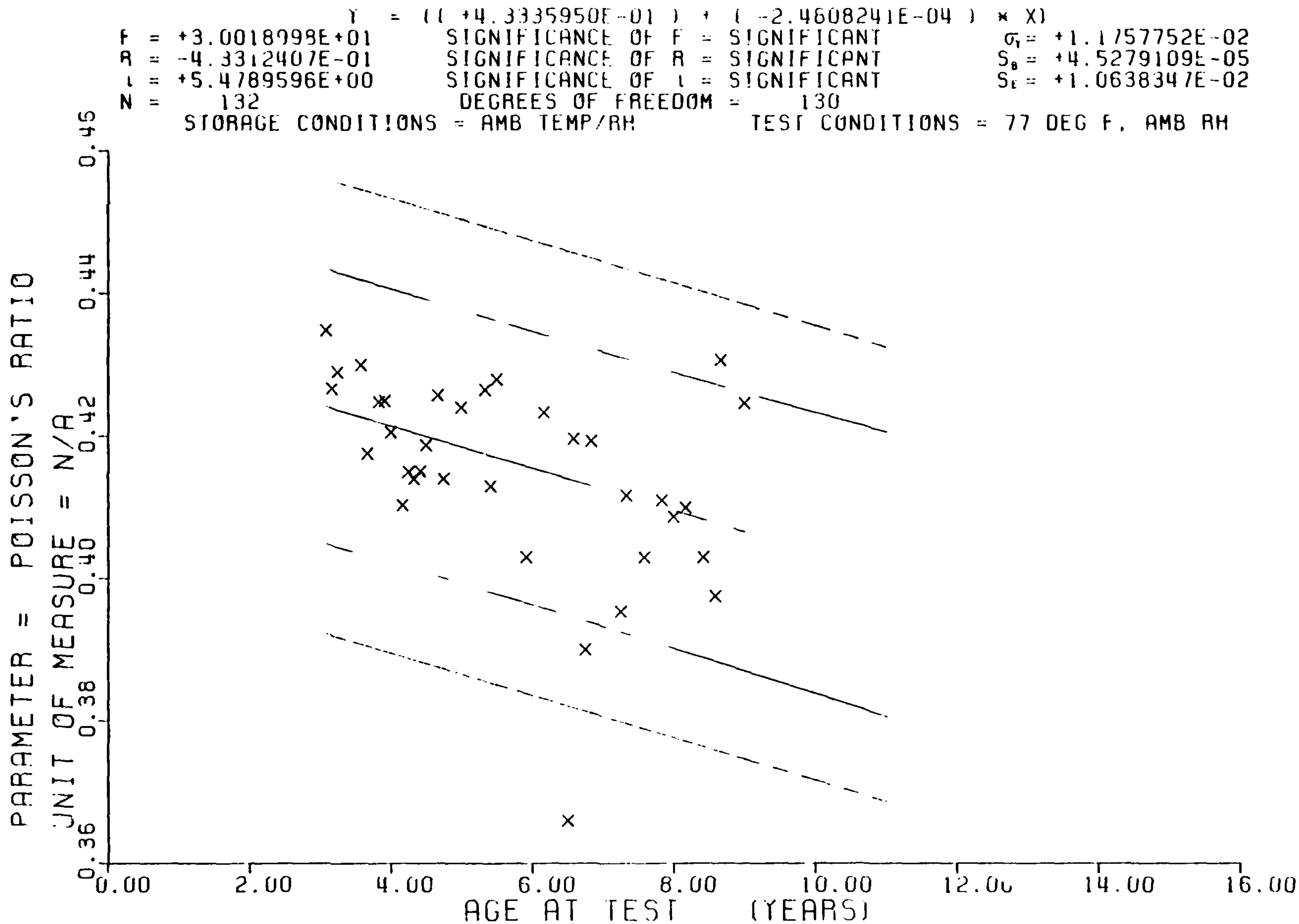
Figure 6-32

```
Y  =  (( +4.2301447E-01 )  +  ( -5.6267638E-05 )  * X)
F = +4.9346192E+00     SIGNIFICANCE OF F = NOT SIGNIFICANT      σ₁ = +1.3382750E-02
R = -1.6247328E-01     SIGNIFICANCE OF R = SIGNIFICANT          Sb = +2.5329806E-05
t = +2.2214002E+00     SIGNIFICANCE OF t = SIGNIFICANT          St = +1.3241160E-02
N =    184              DEGREES OF FREEDOM =    182
   STORAGE CONDITIONS = AMB TEMP/RH           TEST CONDITIONS = 77 DEG F, AMB RH
```



POISSON'S RATIO AT 15% STRAIN, ANB-3066 (ANB P POLYMER UNLINED)

Figure 6-33



POISSON'S RATIO AT 15% STRAIN, ANB-3066 (ANT UNLINED CARTONS)

Figure 6-34

Y = ((+4.3850950E-01) + (-2.7375044E-04) * X)

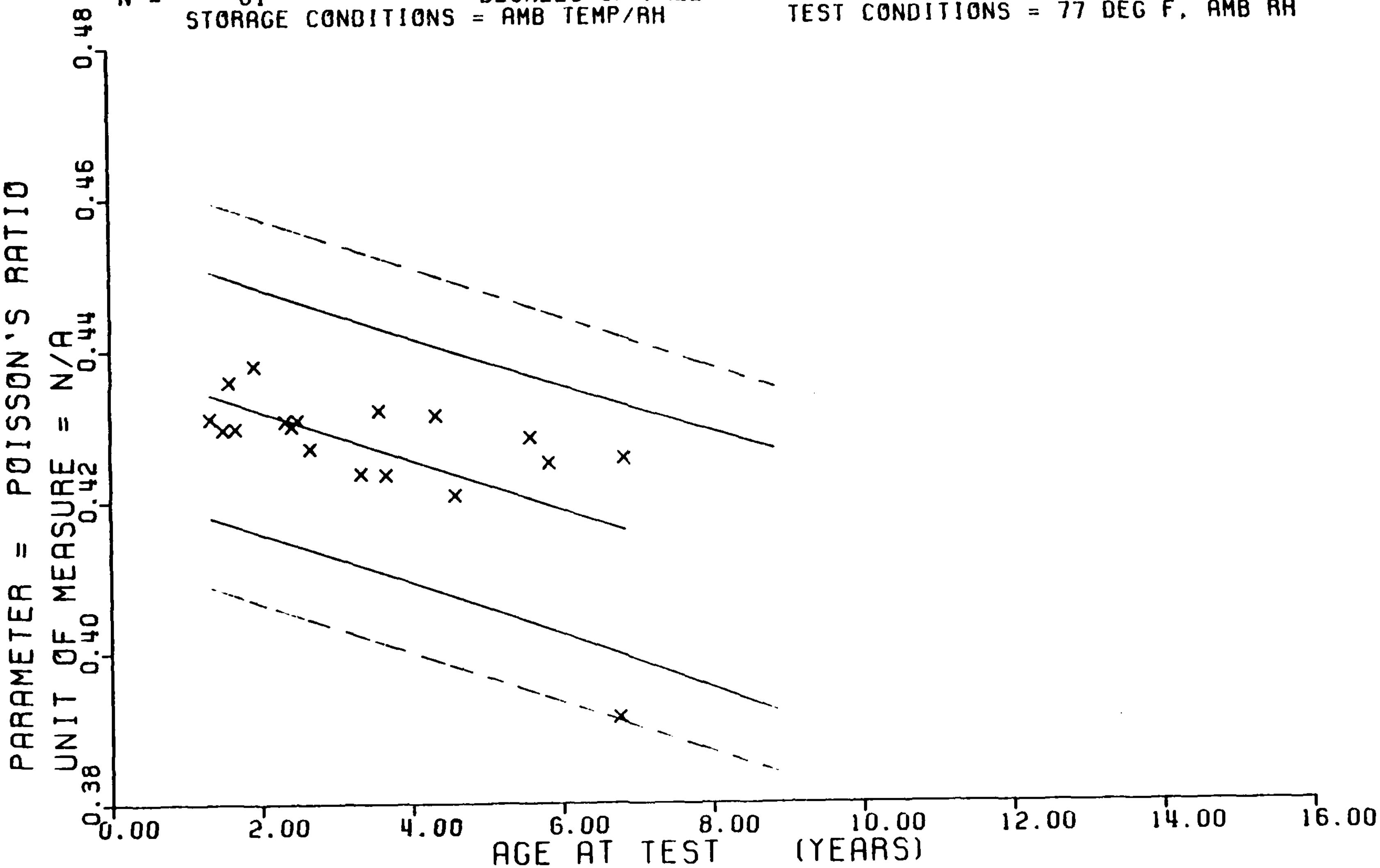
F = +2.8614789E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +1.0237640E-02

R = -5.7148728E-01 SIGNIFICANCE OF R = SIGNIFICANT S_b = +5.1175201E-05

ι = +5.3492793E+00 SIGNIFICANCE OF ι = SIGNIFICANT S_E = +8.4720166E-03

N = 61 DEGREES OF FREEDOM = 59

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



POISSON'S RATIO AT 15% STRAIN, ANB-3066 (ANB G-POLYMER LINED)

Figure 6-35

Y = ((+4.3361418E-01) + (-1.2370263E-04) * X)

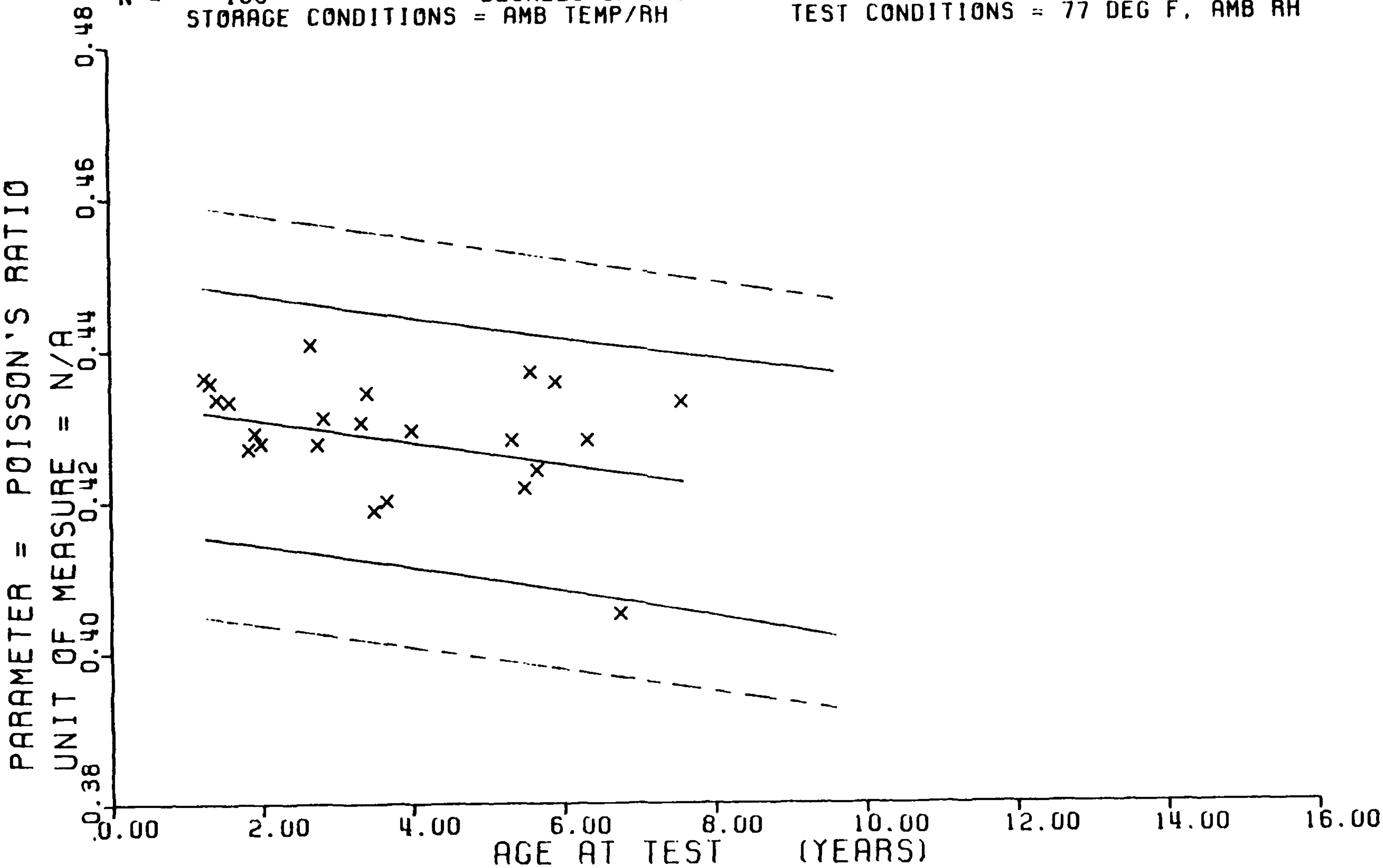
F = +8.6904312E+00 SIGNIFICANCE OF F = SIGNIFICANT σ_T = +9.3309815E-03

R = -2.7894120E-01 SIGNIFICANCE OF R = SIGNIFICANT S_b = +4.1962204E-05

ι = +2.9479537E+00 SIGNIFICANCE OF ι = SIGNIFICANT S_ε = +9.0040109E-03

N = 105 DEGREES OF FREEDOM = 103

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



POISSON'S RATIO AT 15% STRAIN, ANB-3066 (ANB P-POLYMER LINED)

Figure 6-36

Y = ((+4.3059492E-01) + (-2.1644712E-04) × X)

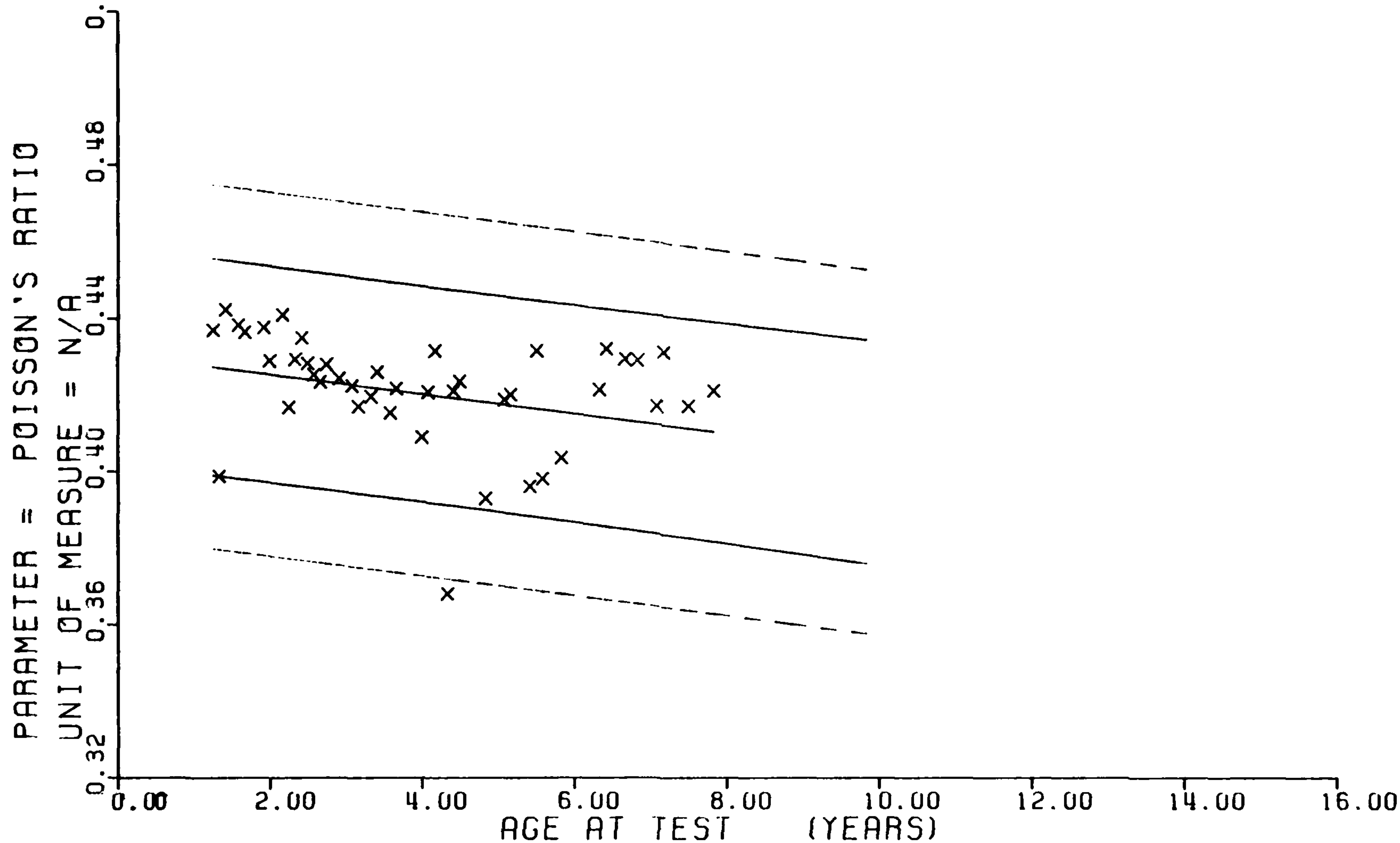
F = +1.3419432E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_r = +1.6397810E-02

R = -2.7048575E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +5.9086022E-05

ι = +3.6632543E+00 SIGNIFICANCE OF ι = SIGNIFICANT S_ι = +1.5832927E-02

N = 172 DEGREES OF FREEDOM = 170

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F. AMB RH



POISSON'S RATIO AT 15% STRAIN, ANB-3066 (ANT LINED CARTONS)

Figure 6-37

Y = ((+1.3135430E+01) + (+2.7595399E-02) * X)

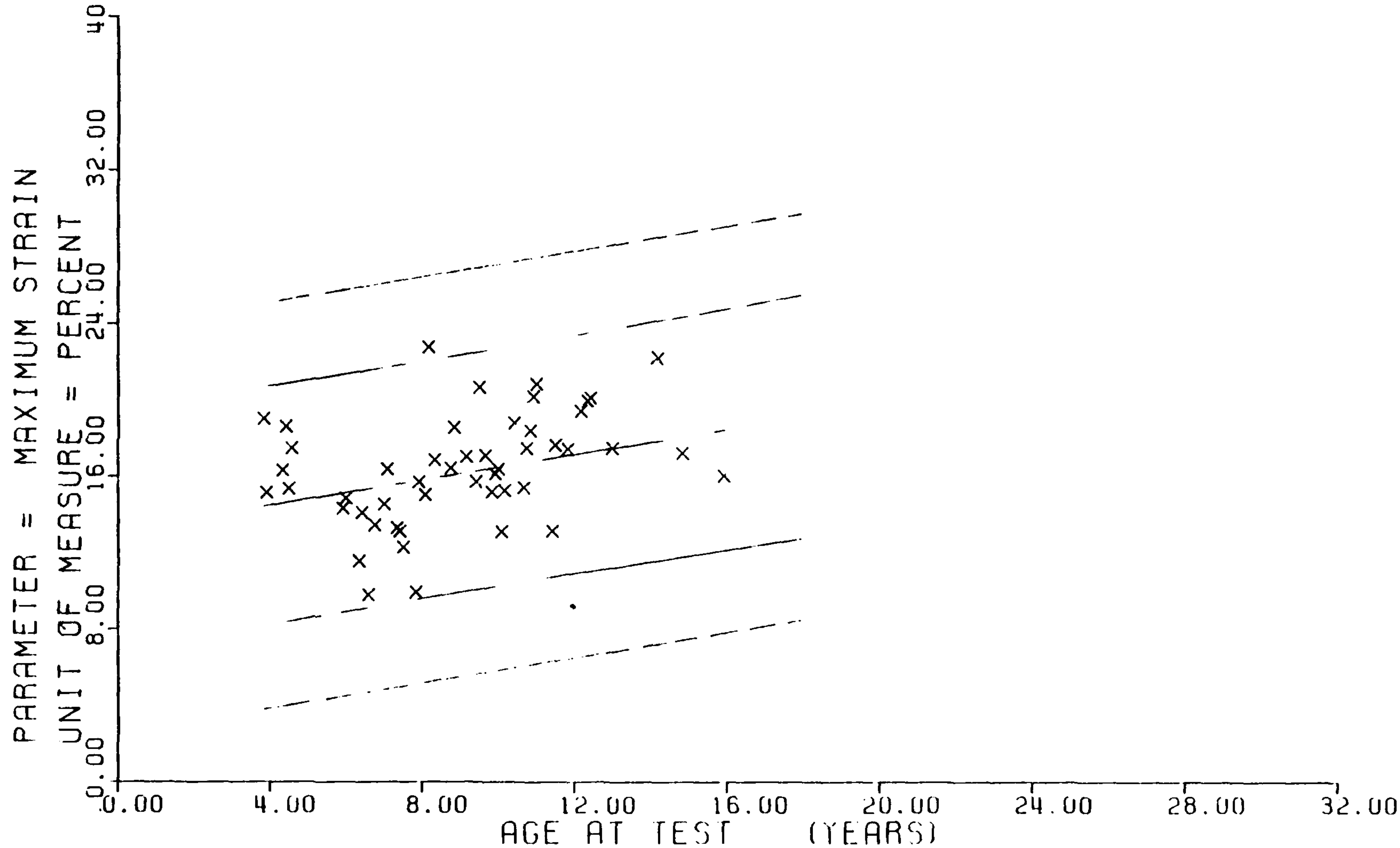
F = +1.4213269E+01   SIGNIFICANCE OF F = SIGNIFICANT σ_T = +3.6373362E+00

R = +2.3461605E-01   SIGNIFICANCE OF R = SIGNIFICANT S_B = +7.3196392E-03

t = +3.7700490E+00   SIGNIFICANCE OF t = SIGNIFICANT S_E = +3.5430494E+00

N = 246   DEGREES OF FREEDOM = 244

STORAGE CONDITIONS = AMB TEMP/RH   TEST CONDITIONS = 77 DEG F, AMB RH



STRAIN DILATATION MAXIMUM STRAIN, 9NB-3066 (ANB G-POLYMER UNLINED)

Figure 6-38

Y = ((+1.6646602E+01) + (+5.8343401E-03) * X)

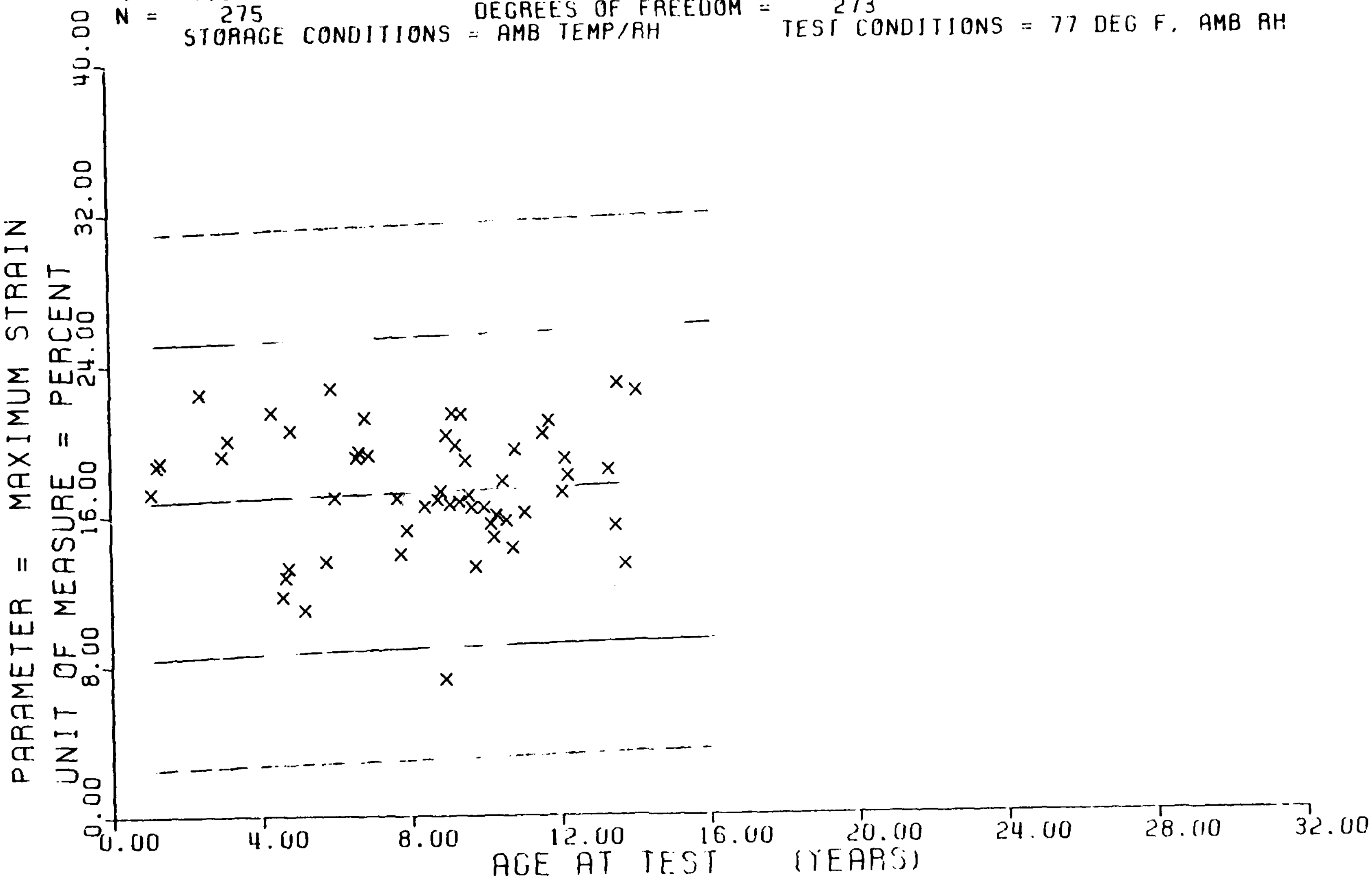
F = +5.4524186E-01 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_Y = +4.7450074E+00

R = +4.4645738E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT S_B = +7.9012826E-03

ι = +7.3840494E-01 SIGNIFICANCE OF ι = NOT SIGNIFICANT S_t = +4.7489500E+00

N = 275 DEGREES OF FREEDOM = 273

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



STRAIN DILATATION MAXIMUM STRAIN, ANB-3066 (ANB P-POLYMER UNLINED)

Figure 6-39

Y = ((+1.4905946E+01) + (+3.3736663E-02) × X)

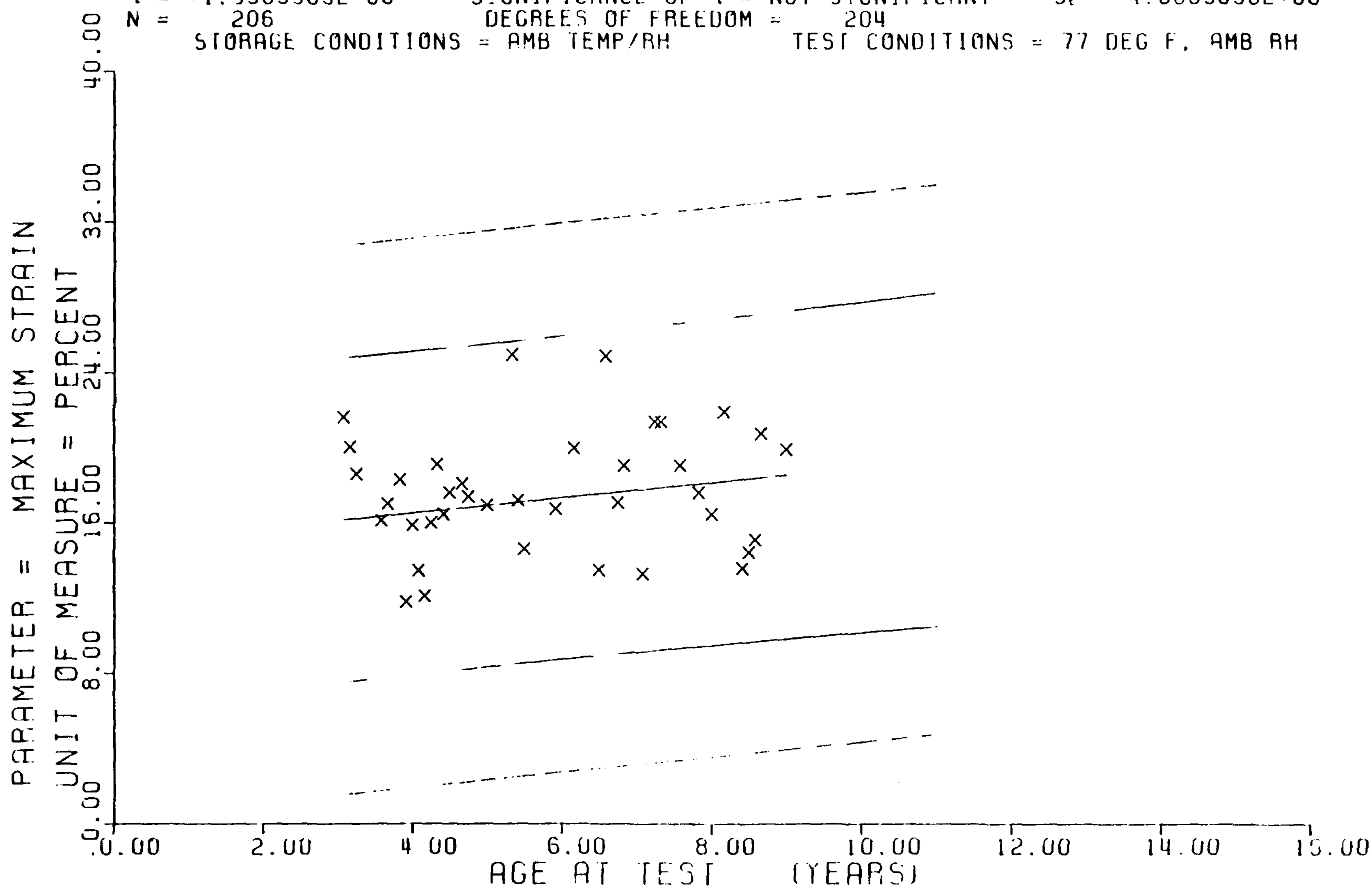
F = +3.7517790E+00 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_1 = +4.9008711E+00

R = +1.3438359E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT S_B = +1.7417406E-02

t = +1.9369509E+00 SIGNIFICANCE OF t = NOT SIGNIFICANT S_t = +4.6683056E+00

N = 206 DEGREES OF FREEDOM = 204

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



STRAIN DILATATION MAXIMUM STRAIN, ANB-3066 (ANT UNLINED)

Figure 6-40

Y = ((+1.8769963E+01) + (-2.5856090E-02) * X)

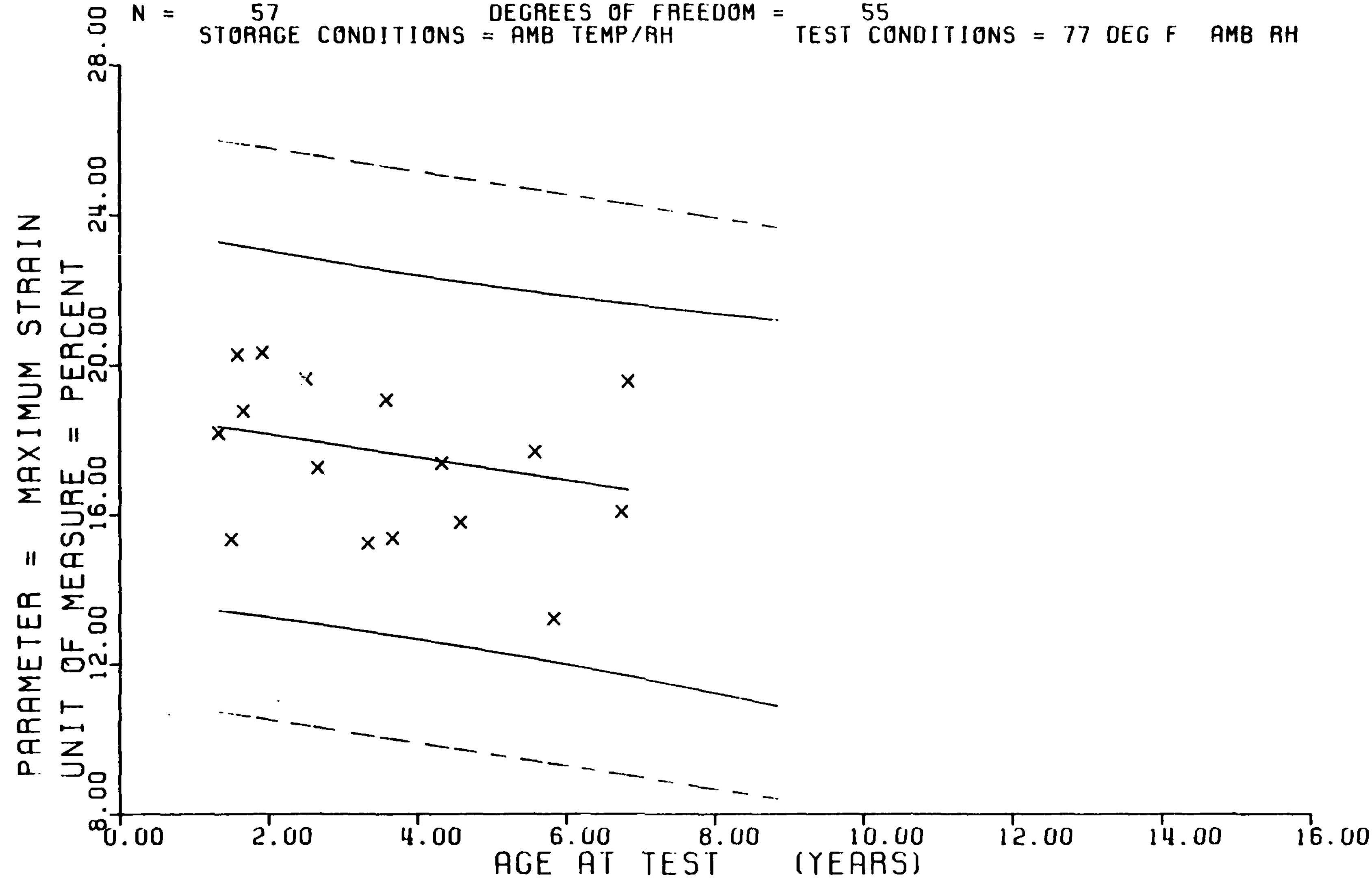
F = +3.0523929E+00 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_Y = +2.5894910E+00

R = -2.2930322E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT S_B = +1.4799350E-02

ι = +1.7471098E+00 SIGNIFICANCE OF ι = NOT SIGNIFICANT S_E = +2.5433045E+00

N = 57 DEGREES OF FREEDOM = 55

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F AMB RH



STRAIN DILATATION MAXIMUM STRAIN, ANB-3066 (ANB G-POLYMER LINED)

Figure 6-41

Y = ((+1.8565231E+01) + (+4.1285876E-05) * X)

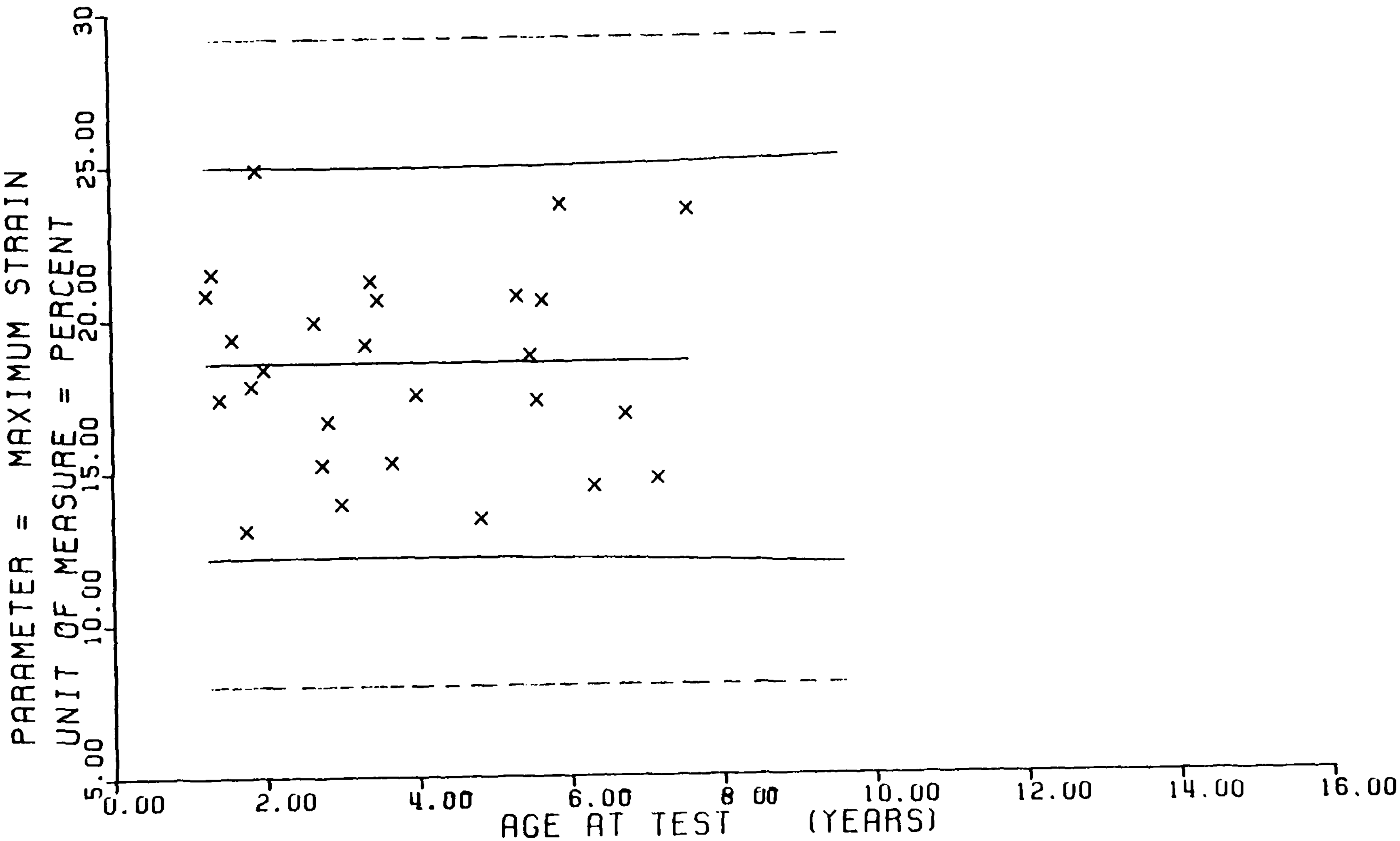
F = +8.0478433E-06 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_T = +3.5155615E+00

R = +2.5173168E-04 SIGNIFICANCE OF R = NOT SIGNIFICANT S_B = +1.4553309E-02

ι = +2.8368721E-03 SIGNIFICANCE OF ι = NOT SIGNIFICANT S_E = +3.5293751E+00

N = 129 DEGREES OF FREEDOM = 127

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



STRAIN DILATATION MAXIMUM STRAIN, ANB-3066 (ANB P-POLYMER LINED)

Figure 6-42

Y = ((+2.0343412E+01) + (-4.6717796E-02) * X)

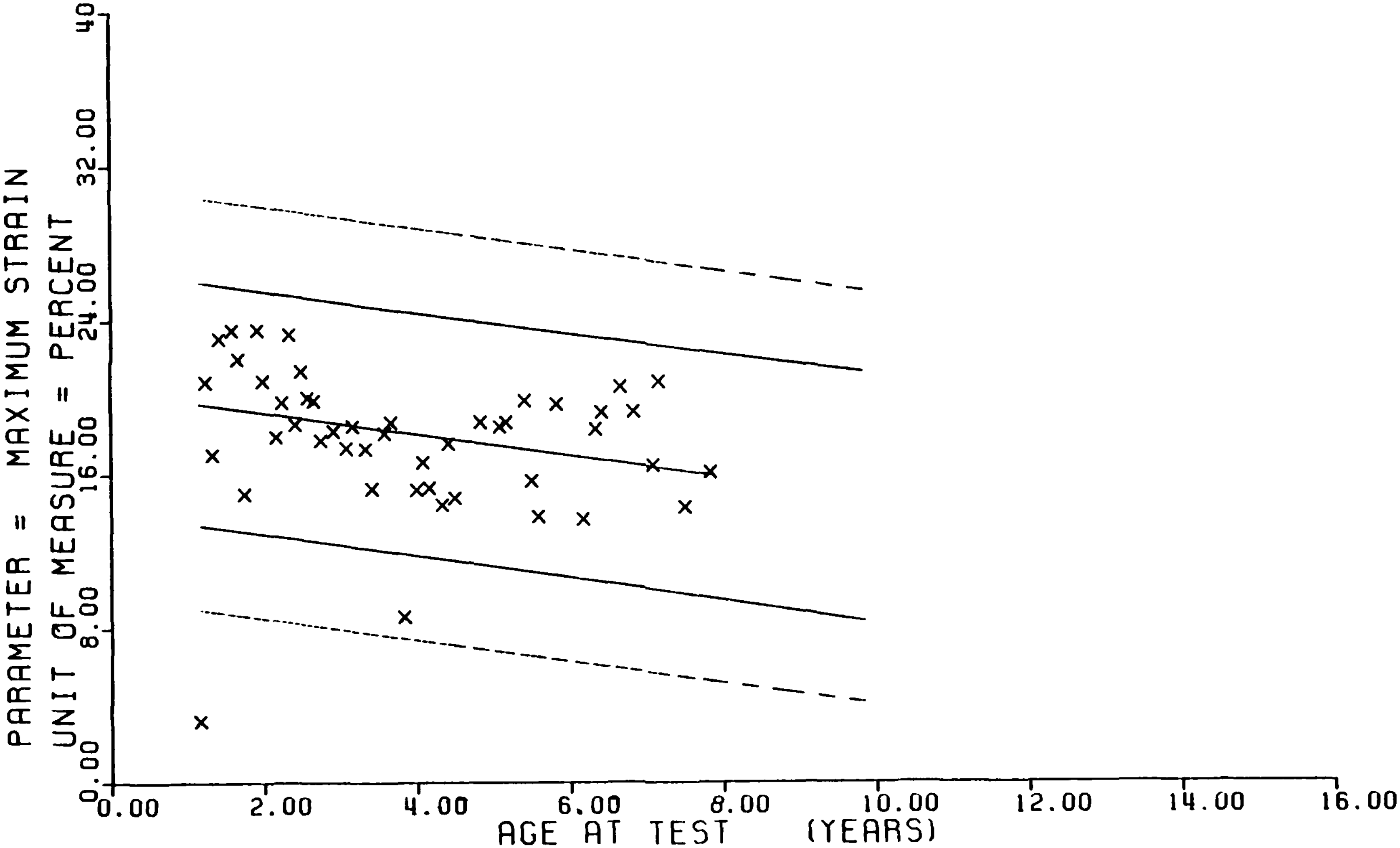
F = +1.5303370E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +3.6829234E+00

R = -2.6178569E-01 SIGNIFICANCE OF R = SIGNIFICANT $S_\bullet$ = +1.1942322E-02

ι = +3.9119522E+00 SIGNIFICANCE OF ι = SIGNIFICANT S_ϵ = +3.5630194E+00

N = 210 DEGREES OF FREEDOM = 208

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



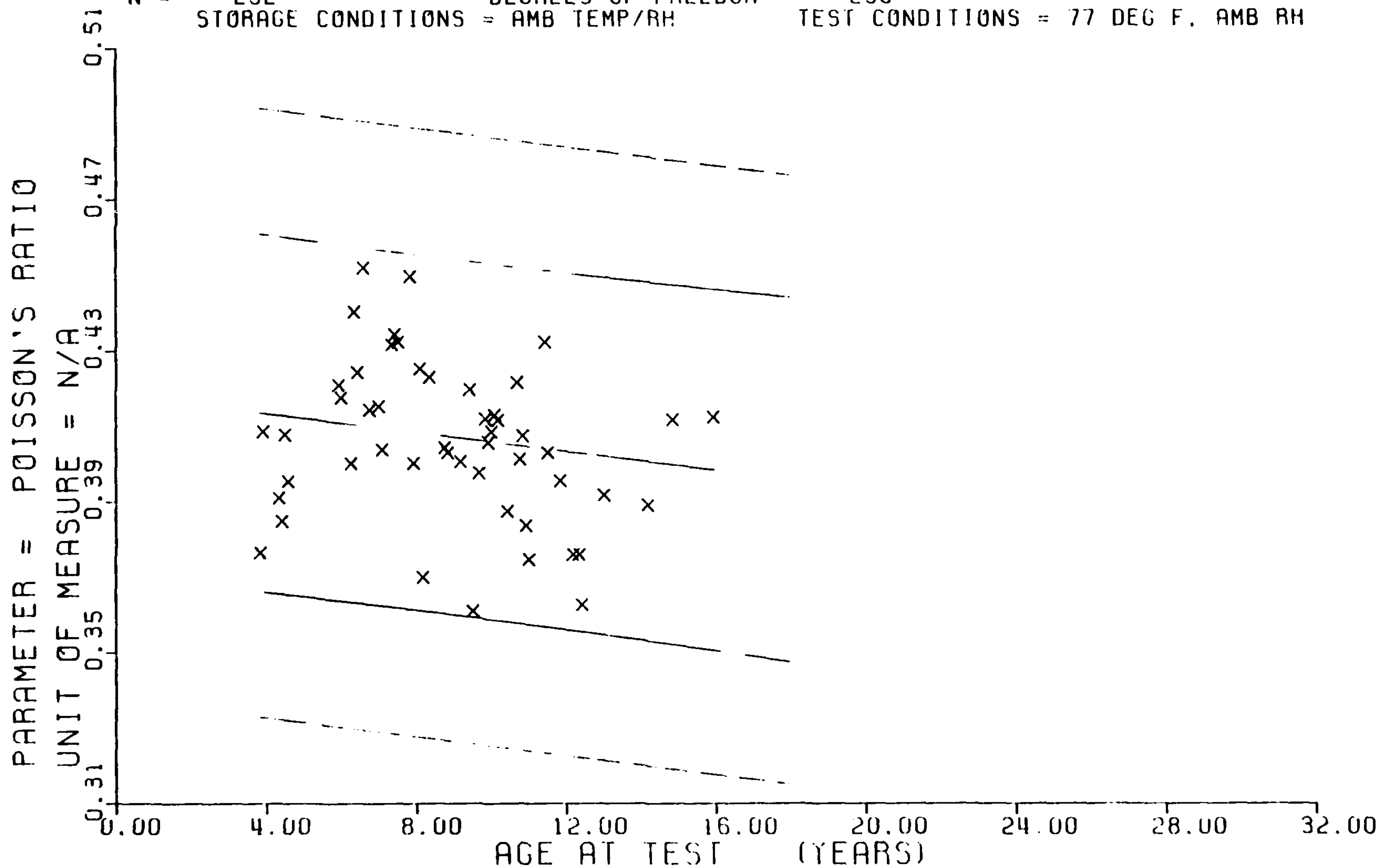
STRAIN DILATATION MAXIMUM STRAIN, ANB-3066 (ANT LINED CARTONS)

Figure 6-43

Y = ((+4.1845637E-01) + (-1.0531824E-04) * X)

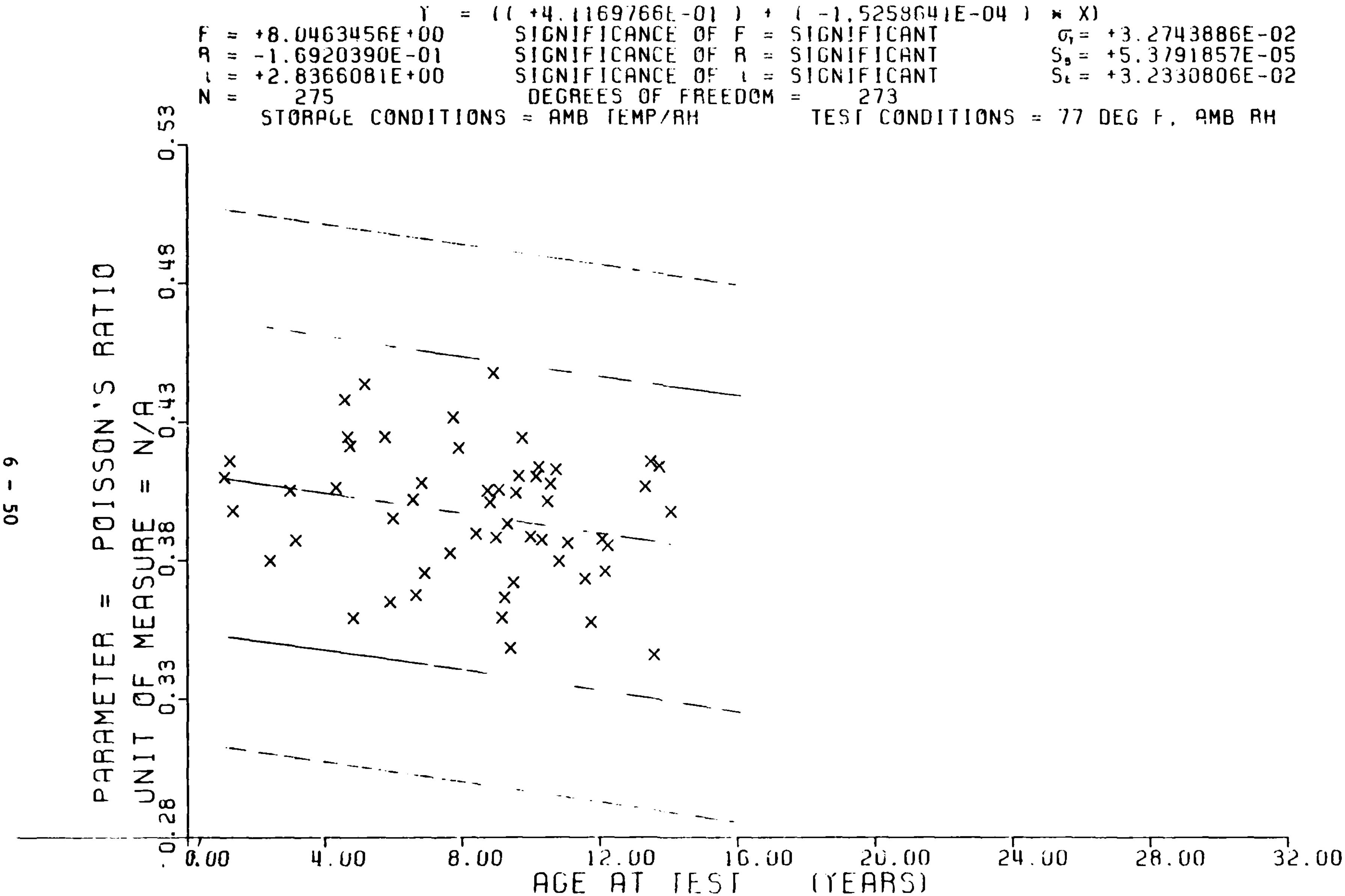
F = +3.6691101E+00 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_T = +2.7025510E-02
R = -1.2026702E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT S_B = +5.4982341E-05
ι = +1.9154921E+00 SIGNIFICANCE OF ι = NOT SIGNIFICANT S_t = +2.6882953E-02
N = 252 DEGREES OF FREEDOM = 250

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F. AMB RH



POISSON'S RATIO AT MAX STRAIN. ANB-3066 (ANB G-POLYMER UNLINED)

Figure 6-44



POISSON'S RATIO AT MAX STRAIN, ANB-3066 (ANB P-POLYMER UNLINED)

Figure 6-45

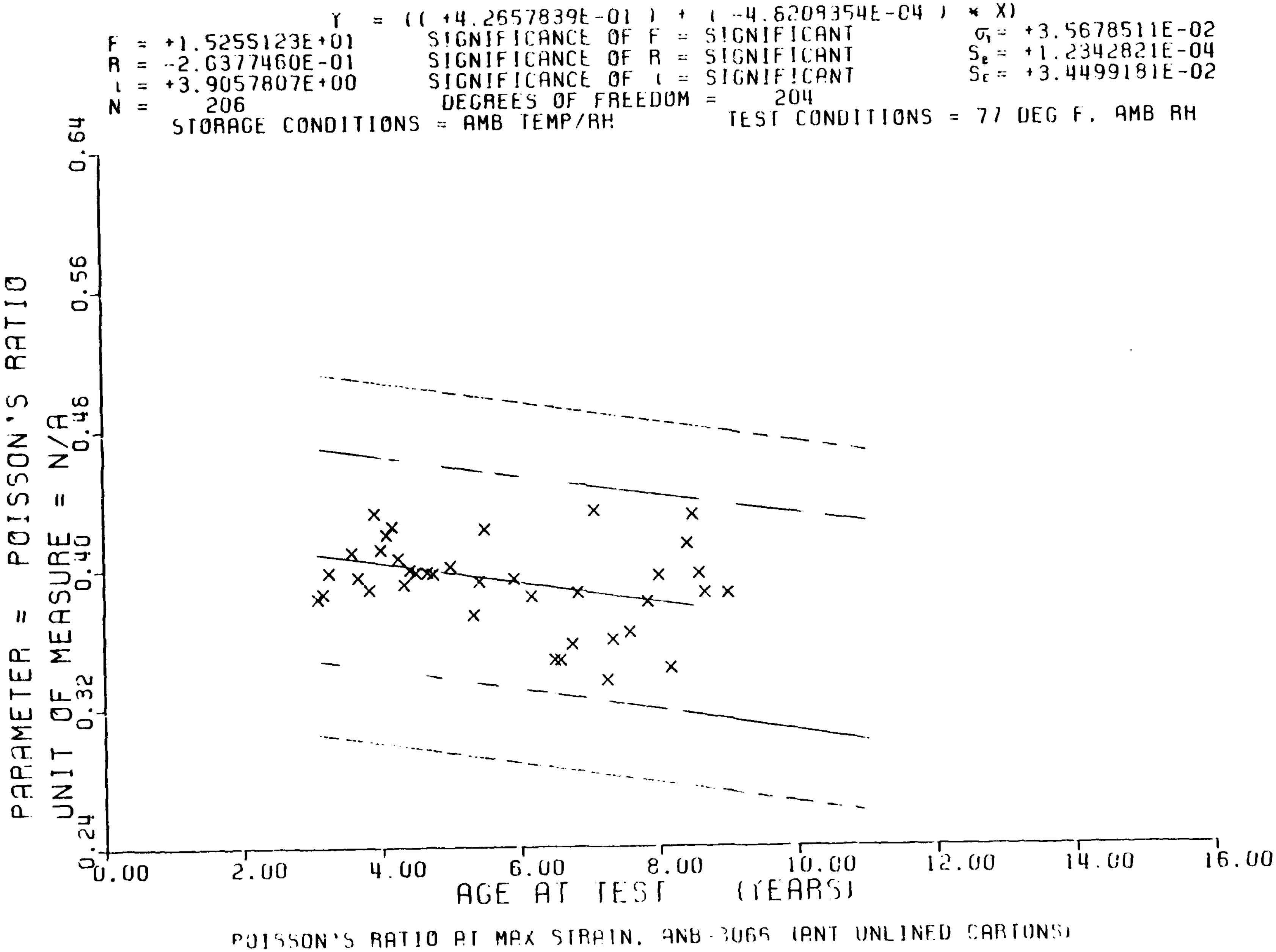
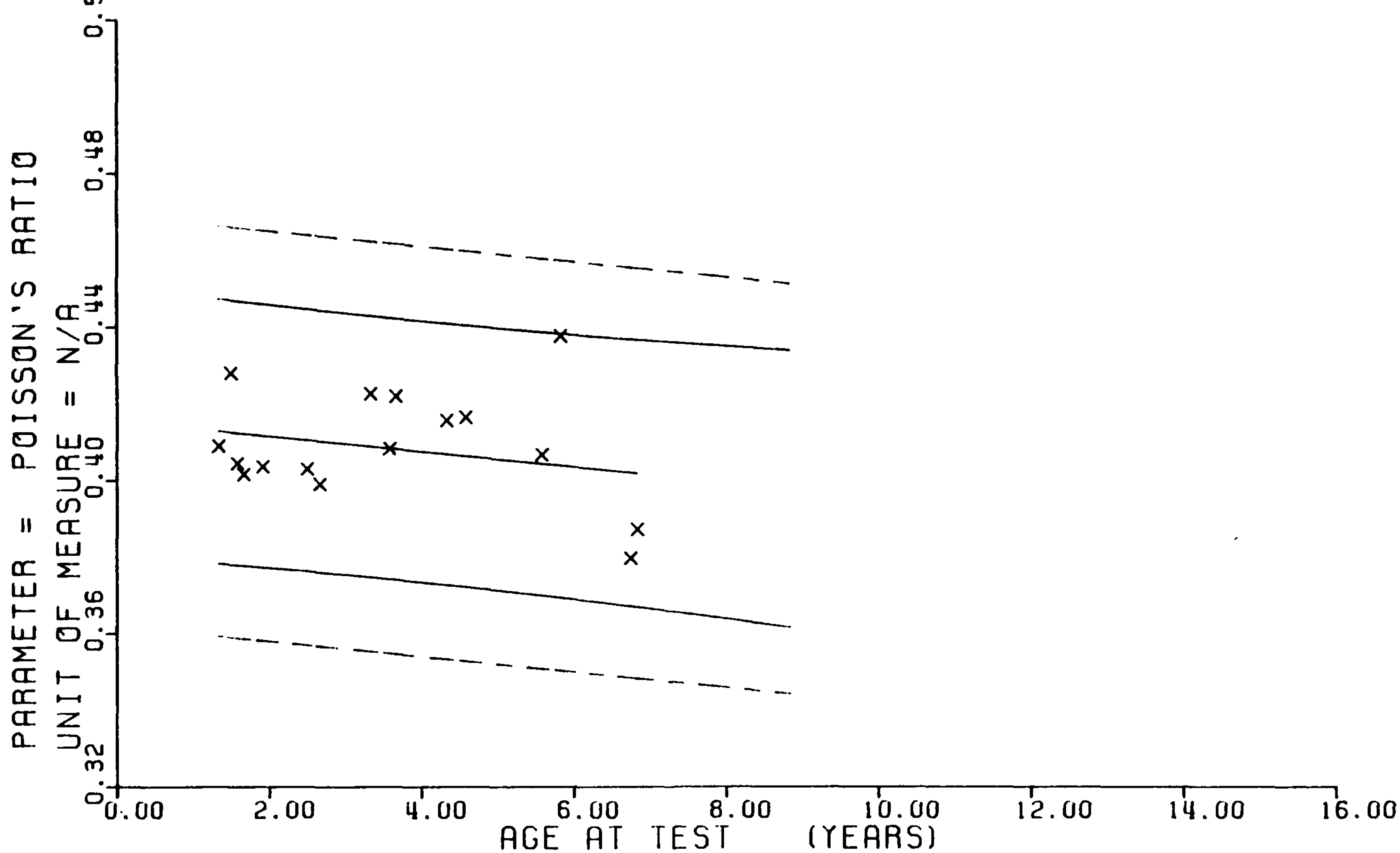

Y = ((+4.2657839E-01) + (-4.6209354E-04) * X)
F = +1.5255123E+01
R = -2.6377460E-01
t = +3.9057807E+00
N = 206
SIGNIFICANCE OF F = SIGNIFICANT
SIGNIFICANCE OF R = SIGNIFICANT
SIGNIFICANCE OF t = SIGNIFICANT
DEGREES OF FREEDOM = 204
σ = +3.5678511E-02
Se = +1.2342821E-04
Sε = +3.4499181E-02
STORAGE CONDITIONS = AMB TEMP/RH
TEST CONDITIONS = 77 DEG F. AMB RH
PARAMETER = POISSON'S RATIO
UNIT OF MEASURE = N/A
0.24
0.32
0.40
0.48
0.56
0.64
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
AGE AT TEST (YEARS)
POISSON'S RATIO AT MAX STRAIN. ANB-3066 (ANT UNLINED CARTONS)

Figure 6-46

Y = ((+4.1557120E-01) + (-1.6806562E-04) * X)

F = +2.6248372E+00 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_Y = +1.8083990E-02
R = -2.1342551E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT S_B = +1.0373557E-04
ι = +1.6201349E+00 SIGNIFICANCE OF ι = NOT SIGNIFICANT S_E = +1.7827211E-02
N = 57 DEGREES OF FREEDOM = 55
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



POISSON'S RATIO AT MAXIMUM STRAIN, ANB-3066 (ANB G-POLYMER LINED)

Figure 6-47

Y = ((+4.1163910E-01) + (-5.2282526E-05) * X)

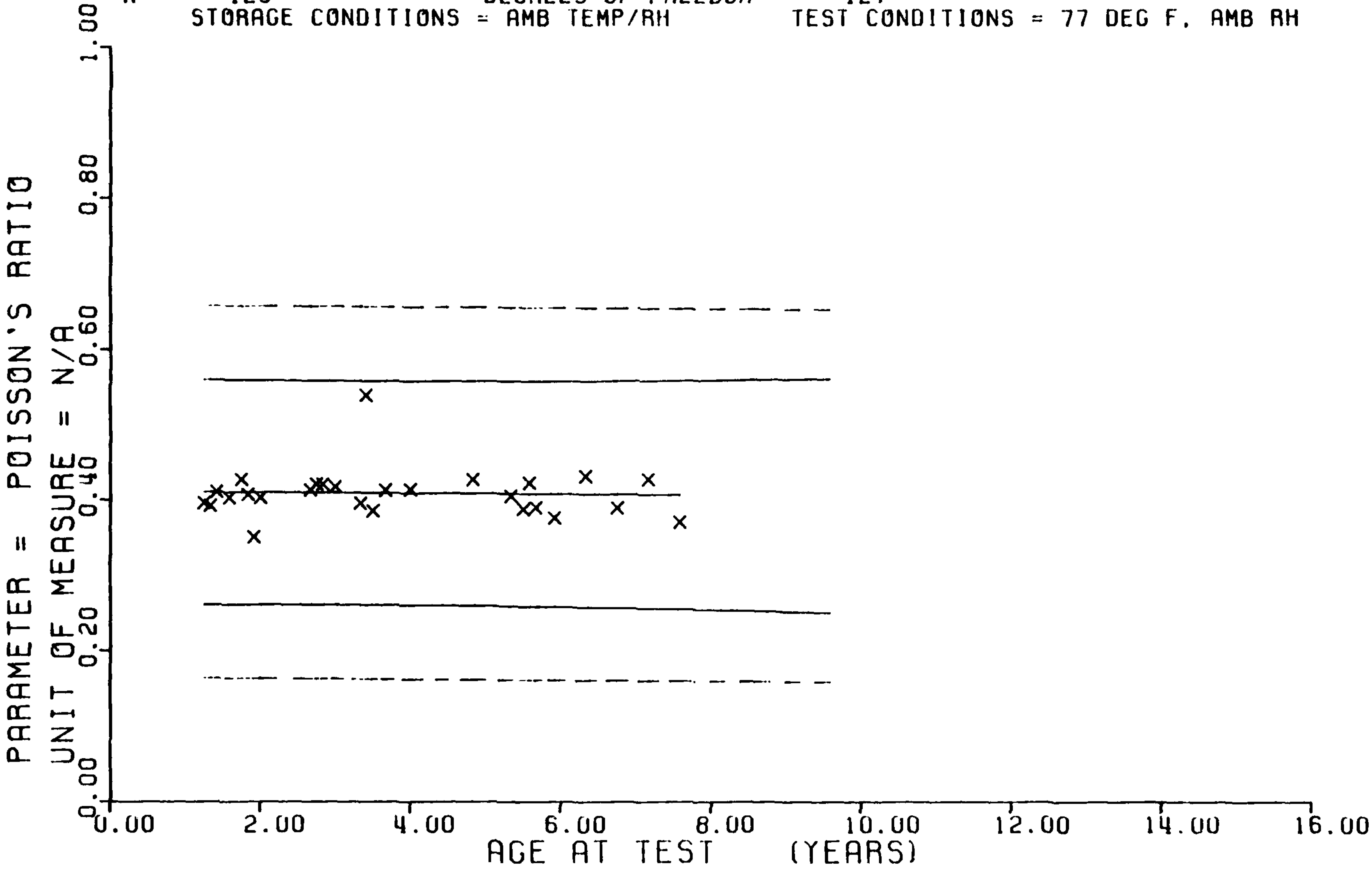
F = +2.3707968E-02 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_Y = +8.2031918E-02

R = -1.3661701E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT S_B = +3.3955442E-04

ι = +1.5397392E-01 SIGNIFICANCE OF ι = NOT SIGNIFICANT S_E = +8.2346559E-02

N = 129 DEGREES OF FREEDOM = 127

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



POISSON'S RATIO AT MAXIMUM STRAIN, ANB-3066 (ANB P-POLYMER LINED)

Figure 6-48

Y = ((+3.9364450E-01) + (+7.5119663E-05) * X)

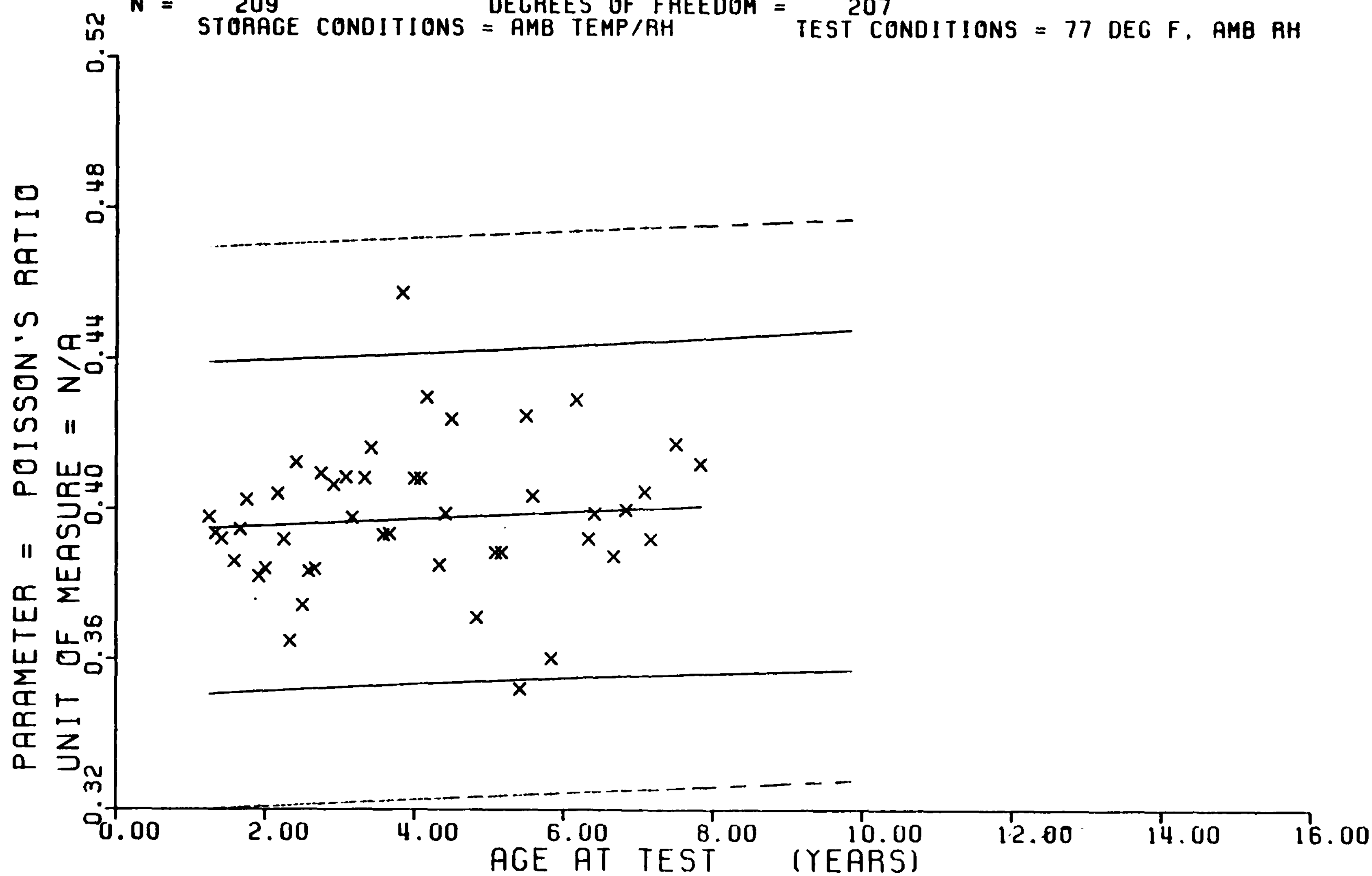
F = +8.0171616E-01 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_T = +2.4893360E-02

R = +6.2113464E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT S_B = +8.3896397E-05

ι = +8.9538604E-01 SIGNIFICANCE OF ι = NOT SIGNIFICANT S_E = +2.4905233E-02

N = 209 DEGREES OF FREEDOM = 207

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG F, AMB RH



POISSON'S RATIO AT MAXIMUM STRAIN, ANB-3066 (ANT LINED CARTONS)

Figure 6-49

SECTION VII

THERMAL COEFFICIENT OF LINEAR EXPANSION

Thermal coefficient of linear expansion (TCLE) is run on the DuPont 990 Thermal Analyzer using the thermomechanical analyzer with expansion probe. The specimen used is a wafer approximately 0.200" (0.508 cm) thick by 0.33" (0.84 cm) diameter. The specimen is cooled to -120°C (-184°F) then heated at 5°C/min (9°F/min) to 40°C (104°F). The glass point (Tg), TCLE below Tg and TCLE above Tg are determined.

According to ASPC, which uses a volume coefficient of expansion, the glass point for propellant stored at 80°F ranges from -91°C (-132°F) to -79.5°C (-111°F). All systems show a significant lowering of the glass point.

Expansion below the glass point is not considered to be a significant factor in analysis. This region is linear. Lined cartons of ANB G and P do not show a trend. Others show a significant increase.

TCLE above Tg is not significant for ANB G lined cartons. ANB G and P unlined cartons do not show a significant increase. ANB P lined and ANT P unlined and lined cartons show a significant decrease in this parameter.

TABLE 7-1

TCLE

Significance of Regression Slopes

System	Tg	Fig	Below Tg	Fig	Above Tg	Fig
ANB G Unlined	Sig dec	7-1	Sig inc	7-7	NS	7-13
ANB P Unlined	Sig dec	7-2	Sig inc	7-8	NS	7-14
ANT P Unlined	Sig dec	7-3	Sig inc	7-9	Sig dec	7-15
ANB G Lined	Sig dec	7-4	NS	7-10	NS	7-16
ANB P Lined	NS	7-5	Sig inc	7-11	Sig dec	7-17
ANT P Lined	Sig dec	7-6	Sig inc	7-12	Sig dec	7-18

TABLE 7-2

ANALYSIS OF COVARIANCE COMPARISON OF REGRESSIONS
THERMAL COEFFICIENT OF LINEAR EXPANSION (TCLE)

		Glass Point	TCLE Below GP	TCLE Above GP
Lined Vs Unlined				
ANB P-polymer	Residual Variance	S	NS	S
	Slope	S	NS	S
	Elevation	S	S	S
ANB G-polymer	Residual Variance	S	NS	S
	Slope	NS	S	NS
	Elevation	S	S	S
ANT P-polymer	Residual Variance	S	NS	S
	Slope	S	S	S
	Elevation	S	S	NS
ANB P Unlnd Vs ANT P Lined	Residual Variance	S	S	S
	Slope	NS	NS	S
	Elevation	S	S	NS
G-polymer Vs P-polymer				
ANB Lined	Residual Variance	S	NS	S
	Slope	NS	S	NS
	Elevation	S	NS	S
ANB Unlined	Residual Variance	S	NS	S
	Slope	NS	NS	NS
	Elevation	NS	NS	NS
ANB G Unlnd Vs ANT P Unlnd	Residual Variance	S	S	S
	Slope	S	S	S
	Elevation	S	S	NS
ANB G Lined Vs ANT P Lined	Residual Variance	S	S	S
	Slope	NS	NS	NS
	Elevation	S	S	S
ANB P-polymer Vs ANT P-polymer				
Lined	Residual Variance	NS	S	S
	Slope	S	NS	S
	Elevation	S	S	S
Unlined	Residual Variance	NS	S	S
	Slope	S	S	S
	Elevation	S	S	NS

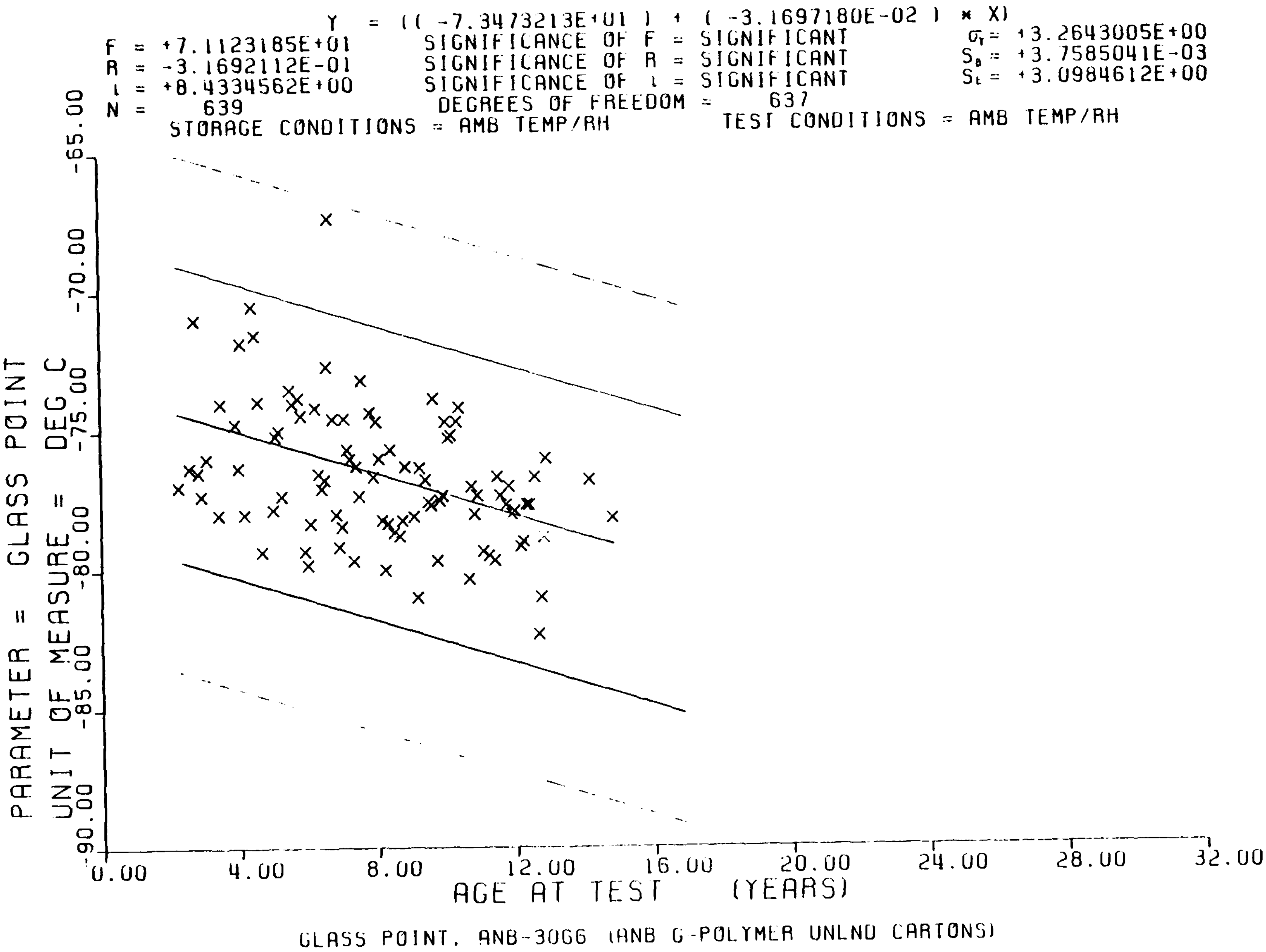

Y = ((-7.3473213E+01) + (-3.1697180E-02) * X)
F = +7.1123185E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_T = +3.2643005E+00
R = -3.1692112E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +3.7585041E-03
t = +8.4334562E+00 SIGNIFICANCE OF t = SIGNIFICANT S_t = +3.0984612E+00
N = 639 DEGREES OF FREEDOM = 637
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = GLASS POINT
UNIT OF MEASURE = DEG C
-65.00
-70.00
-75.00
-80.00
-85.00
-90.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
GLASS POINT. ANB-3066 (ANB G-POLYMER UNLND CARTONS)

Figure 7-1

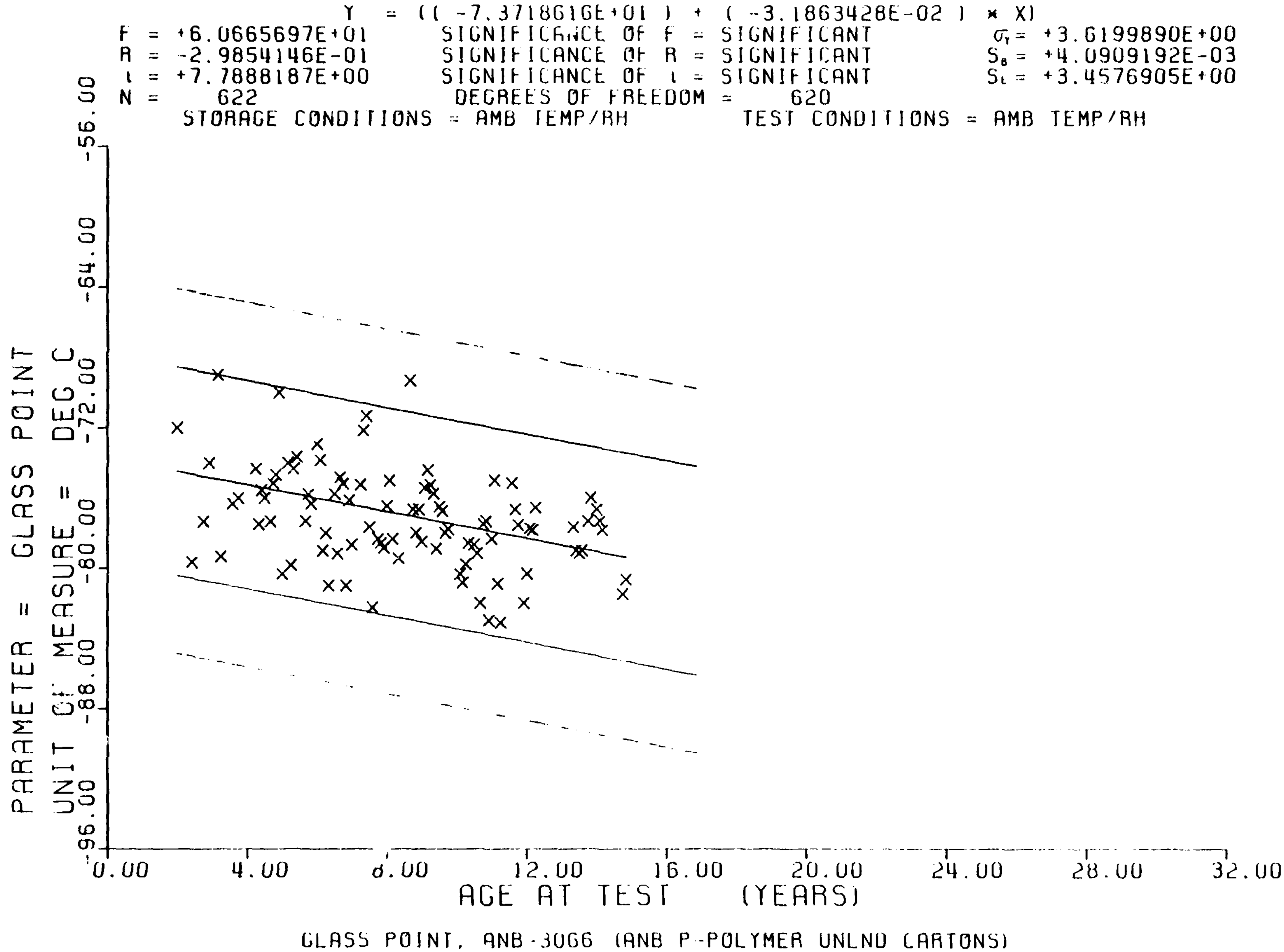

Y = ((-7.3718616E+01) + (-3.1863428E-02) * X)
F = +6.0665697E+01 SIGNIFICANCE OF F = SIGNIFICANT σT = +3.6199890E+00
R = -2.9854146E-01 SIGNIFICANCE OF R = SIGNIFICANT SB = +4.0909192E-03
t = +7.7888187E+00 SIGNIFICANCE OF t = SIGNIFICANT St = +3.4576905E+00
N = 622 DEGREES OF FREEDOM = 620
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = GLASS POINT
UNIT OF MEASURE = DEG C
-56.00
-64.00
-72.00
-80.00
-88.00
-96.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
GLASS POINT, ANB-3066 (ANB P-POLYMER UNLND CARTONS)

Figure 7-2

Y = ((-7.0849018E+01) + (-9.4295553E-02) * X)

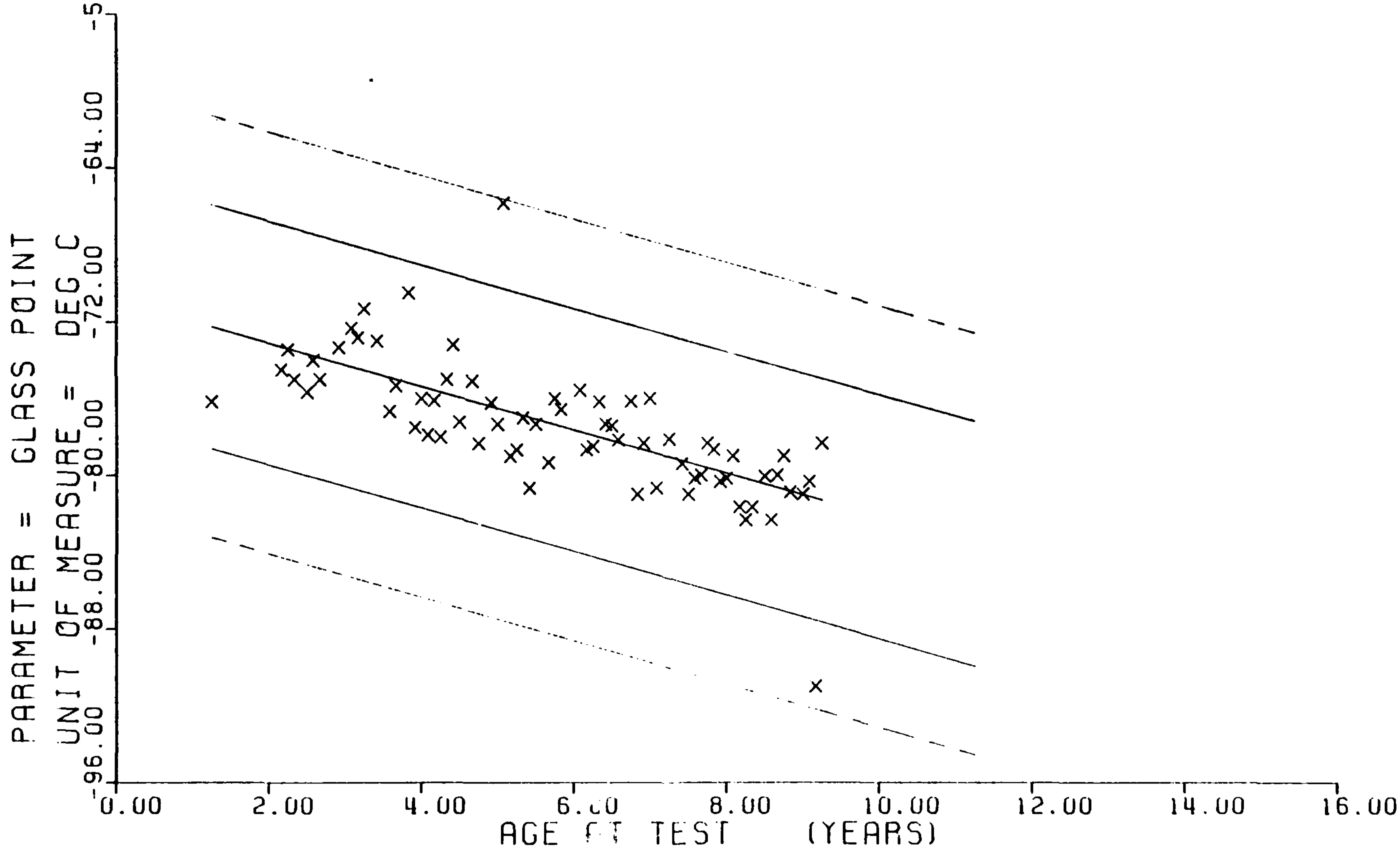
F = +1.6752769E+02 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +4.3409709E+00

R = -5.4046317E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +7.2853079E-03

t = +1.2943248E+01 SIGNIFICANCE OF t = SIGNIFICANT S_E = +3.6568477E+00

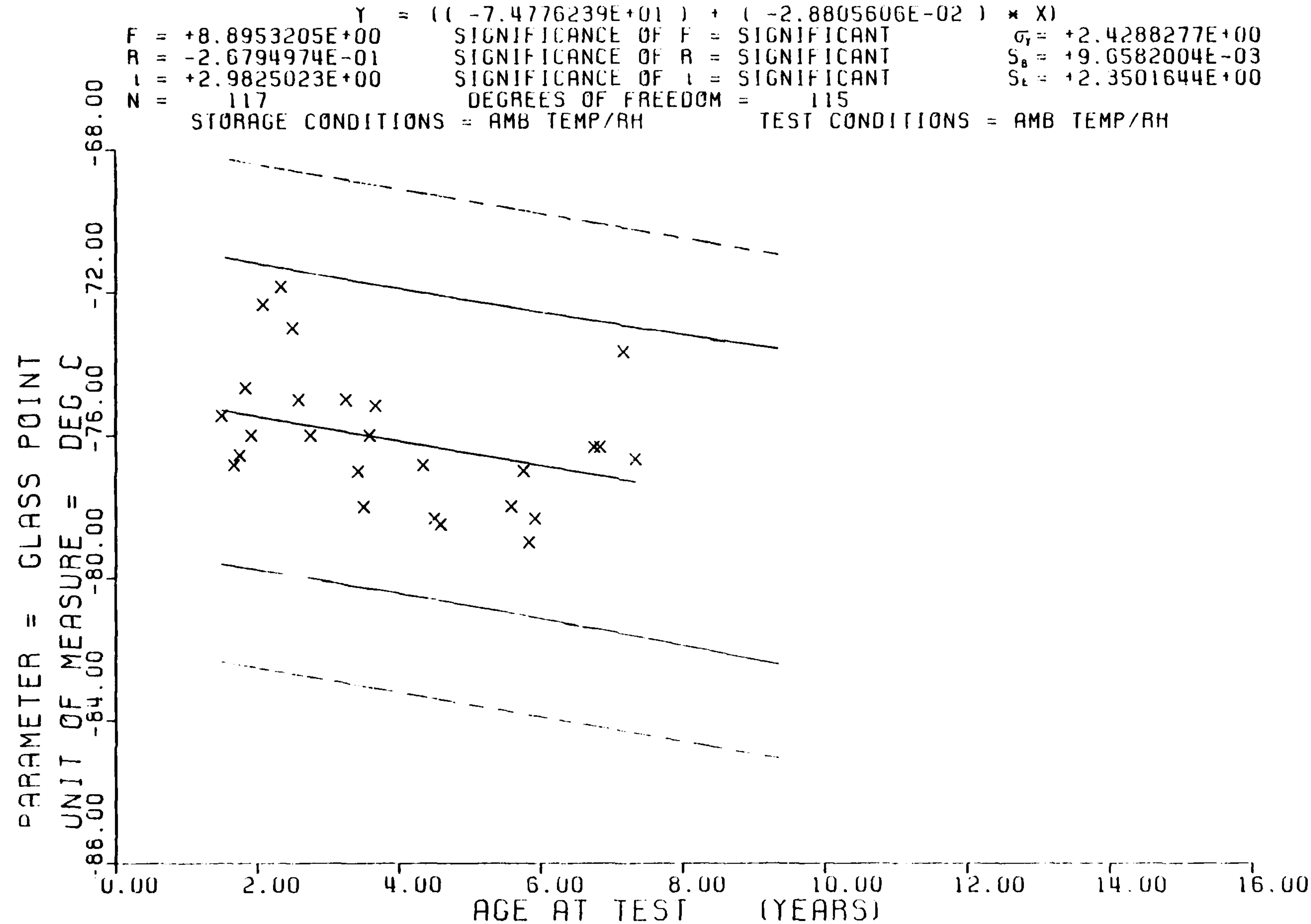
N = 408 DEGREES OF FREEDOM = 406

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



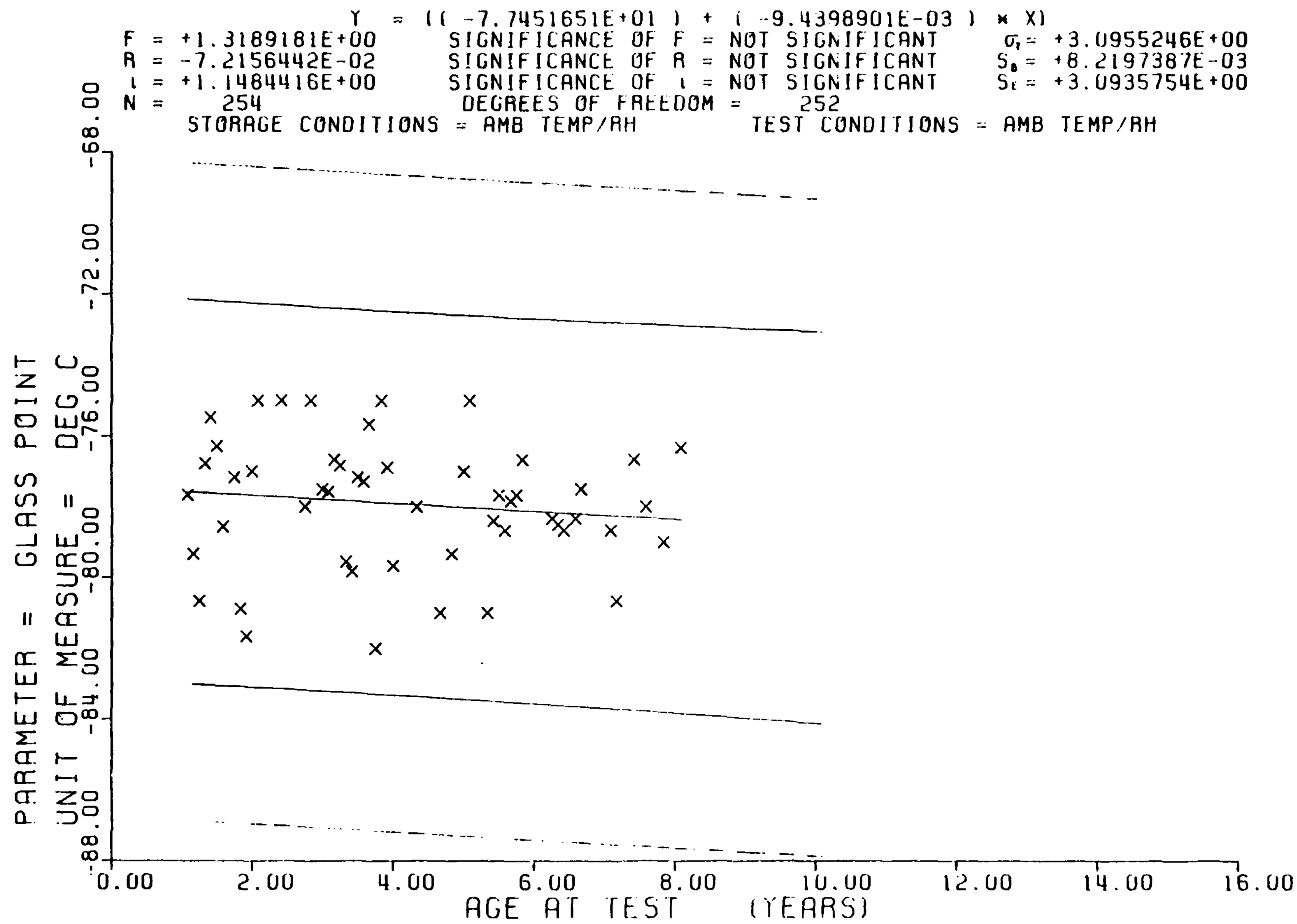
GLASS POINT, ANB [illegible]56 (ANT P-POLYMER UNLND CARTONS)

Figure 7-3



GLASS POINT, ANB-3066 (ANB G-POLYMER LINED CARTONS)

Figure 7-4



GLASS POINT, ANB-3066 (ANB P-POLYMER LINED CARTONS)

Figure 7-5

Y = ((-7.4862687E+01) + (-4.3655511E-02) * X)

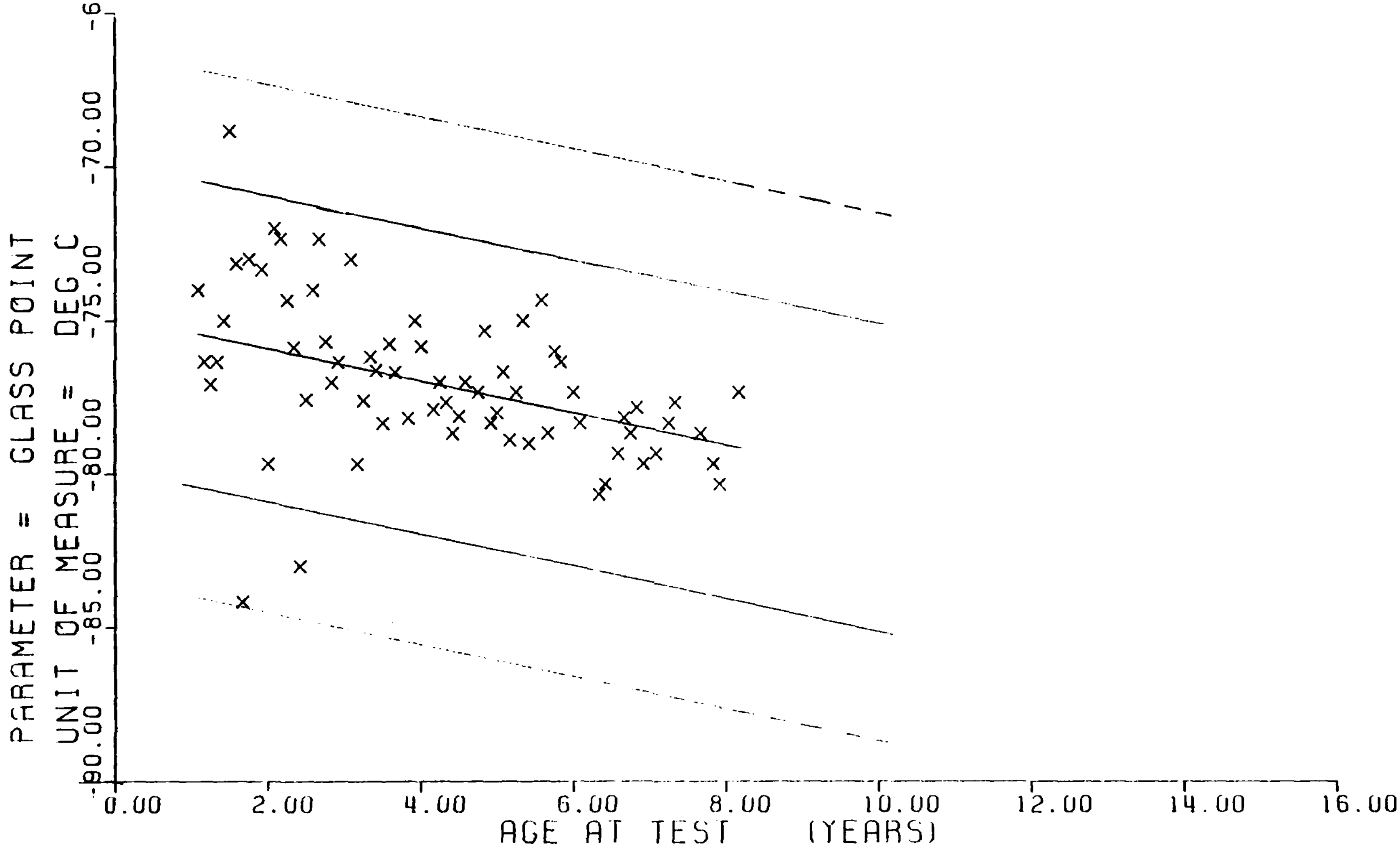
F = +4.1876325E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +3.0258052E+00

R = -3.2773351E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +6.7461313E-03

t = +6.4711919E+00 SIGNIFICANCE OF t = SIGNIFICANT S_E = +2.8627950E+00

N = 350 DEGREES OF FREEDOM = 348

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



GLASS POINT, ANB-3066 (ANT P-POLYMER LINED CARTONS)

Figure 7-6

Y = ((+5.0241684E-05) + (+5.9094987E-08) * X)

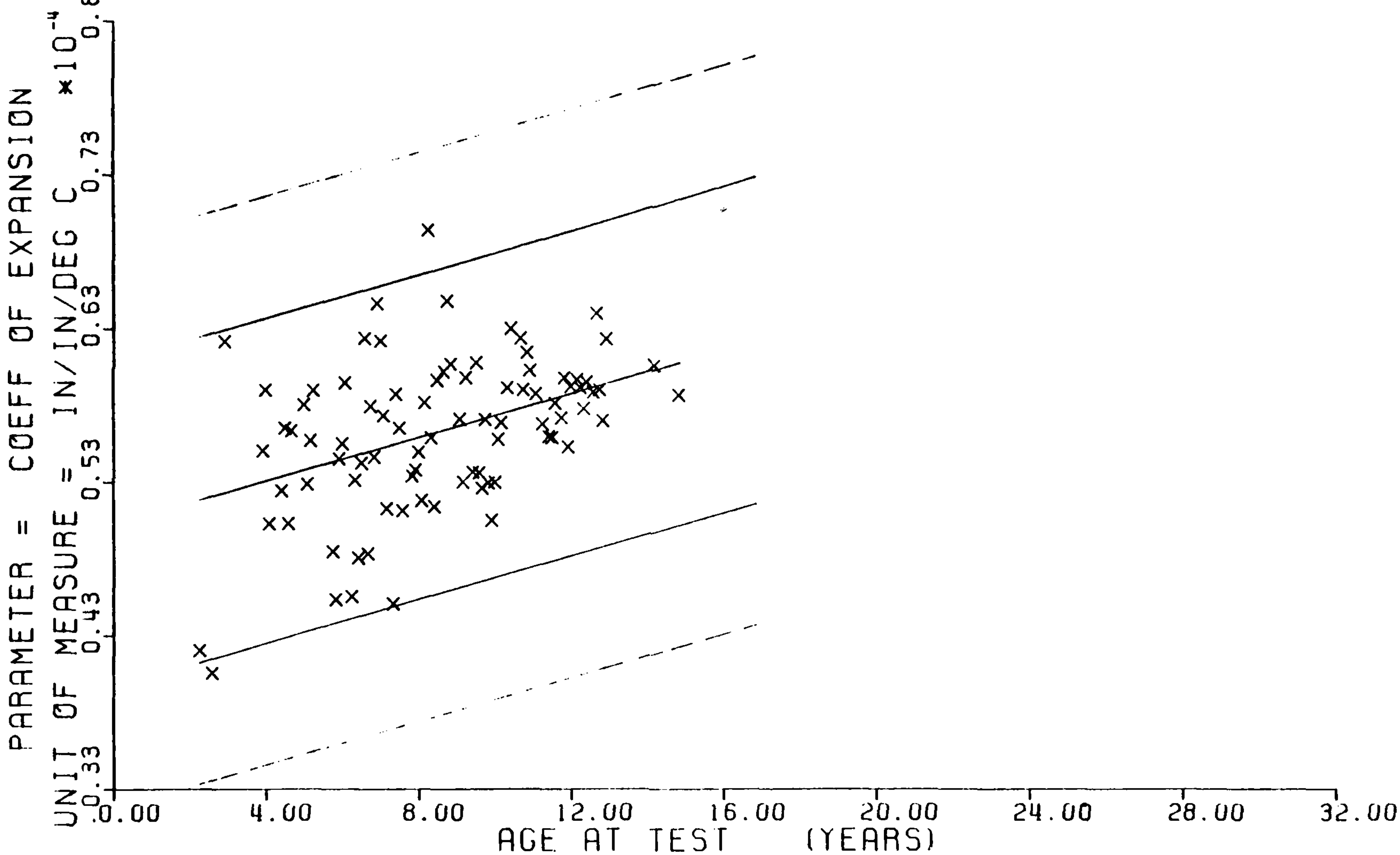
F = +5.3224354E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_T = +6.4367004E-06

R = +2.8743300E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +8.1001943E-09

t = +7.2955023E+00 SIGNIFICANCE OF t = SIGNIFICANT S_E = +6.1702901E-06

N = 593 DEGREES OF FREEDOM = 591

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



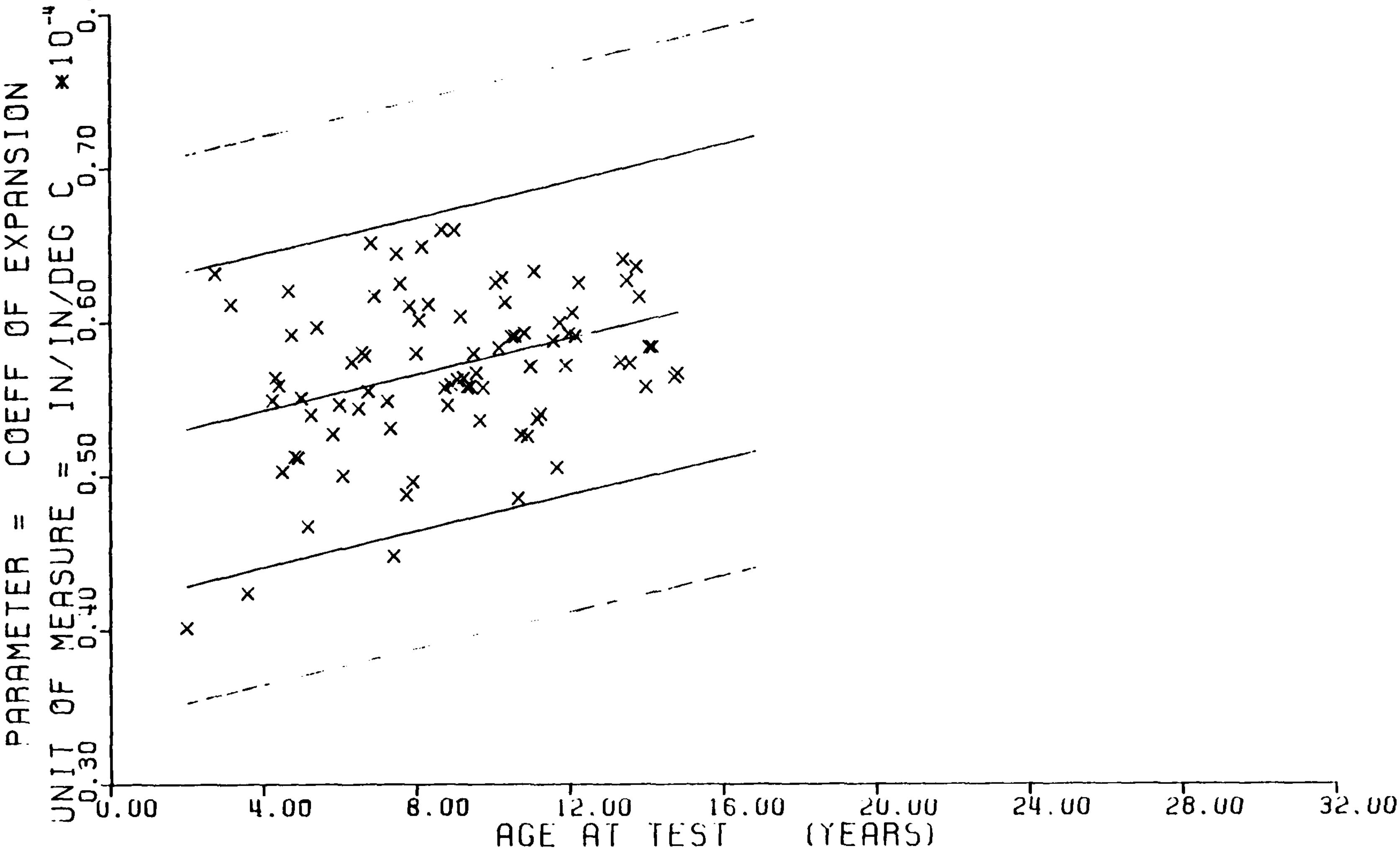
ICLE BELOW GLASS POINT, ANB-3066 (ANB G-POLYMER UNLND CARTONS)

Figure 7-7

Y = ((+5.1903256E-05) + (+4.9182756E-08) * X)

F = +4.2998770E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +6.1472003E-06
R = +2.6313744E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +7.5004072E-09
ι = +6.5573448E+00 SIGNIFICANCE OF ι = SIGNIFICANT S_E = +5.9356908E-06
N = 580 DEGREES OF FREEDOM = 576

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



TCLE BELOW GLASS POINT, ANB-3066 (ANB P-POLYMER UNLND CARTONS)

Figure 7-8

Y = ((+4.4413590E-05) + (+1.7964040E-07) * X)

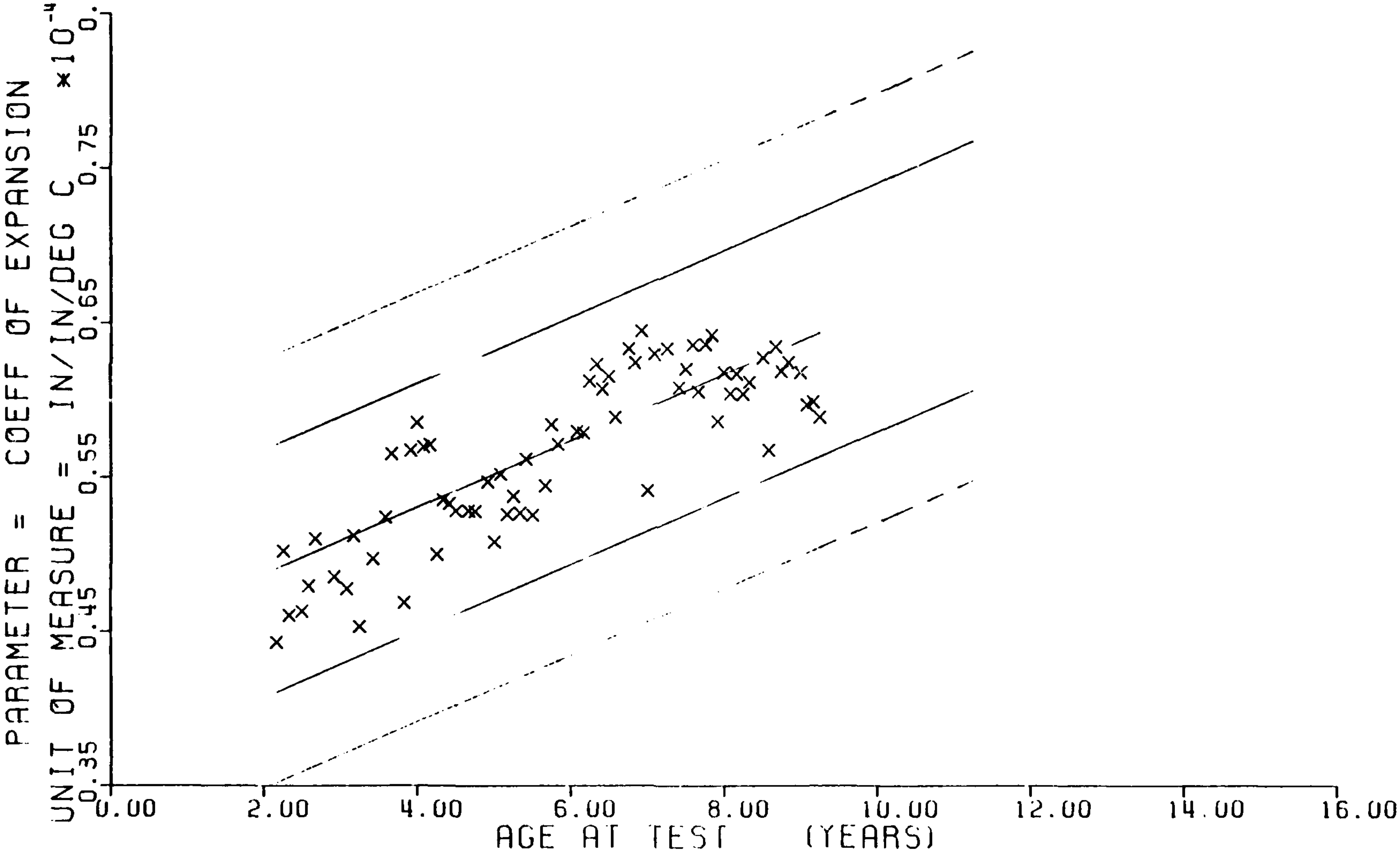
F = +3.5245461E+02 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +6.3485056E-06

R = +6.8440227E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +9.5686886E-09

t = +1.6773774E+01 SIGNIFICANCE OF t = SIGNIFICANT S_E = +4.6345069E-06

N = 402 DEGREES OF FREEDOM = 400

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



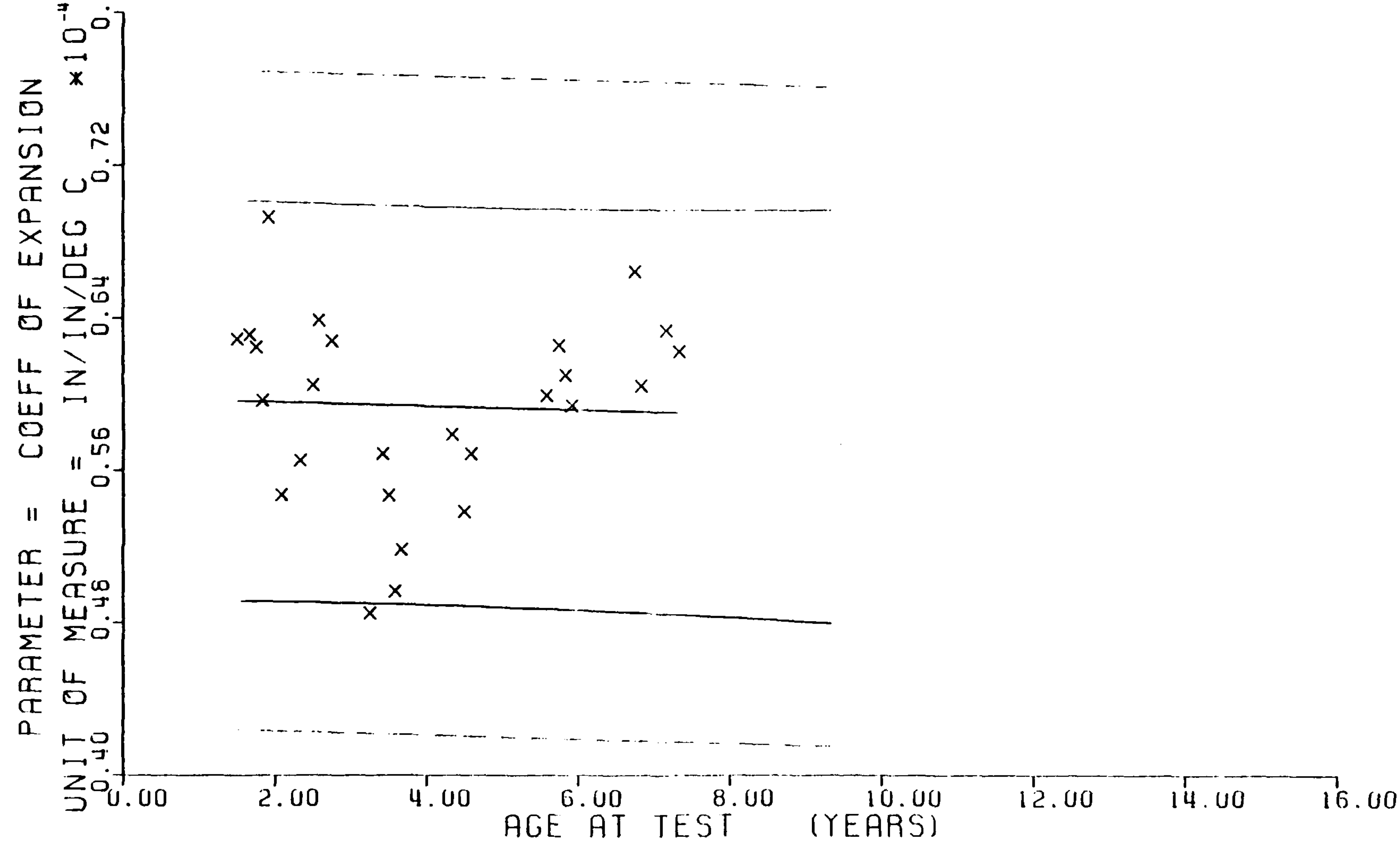
TCLE BELOW GLASS POINT. ANB-3066 (ANT P-POLYMER UNLND CARTONS)

Figure 7-9

Y = ((+5.9840856E-05) + (-9.2902074E-09) * X)

F = +1.5382915E-01   SIGNIFICANCE OF F = NOT SIGNIFICANT σ_Y = +5.7427289E-06
R = -3.6549390E-02   SIGNIFICANCE OF R = NOT SIGNIFICANT S_B = +2.3686782E-08
t = +3.9221060E-01   SIGNIFICANCE OF t = NOT SIGNIFICANT S_t = +5.7637896E-06
N = 117   DEGREES OF FREEDOM = 115

STORAGE CONDITIONS = AMB TEMP/RH   TEST CONDITIONS = AMB TEMP/RH



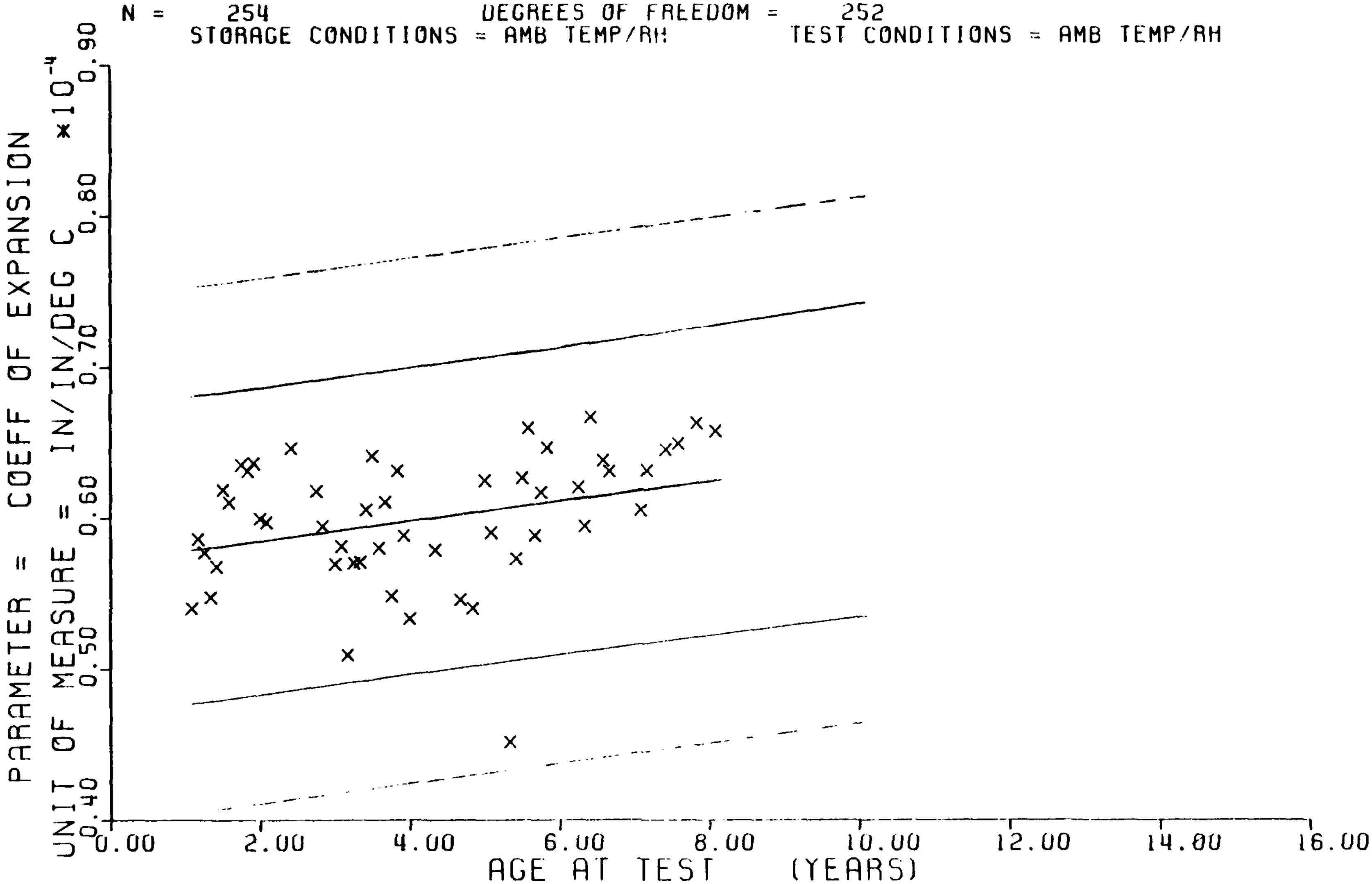
TCLE BELOW GLASS POINT, ANB-3066 (ANB G-POLYMER LINED CARTONS)

Figure 7-10

Y = ((+5.7150915E-05) + (+5.5565992E-08) × X)

F = +1.2988950E+01   SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +5.9385219E-06
R = +2.2139771E-01   SIGNIFICANCE OF R = SIGNIFICANT S_B = +1.5417787E-08
t = +3.6040186E+00   SIGNIFICANCE OF t = SIGNIFICANT S_t = +5.8026282E-06
N = 254   DEGREES OF FREEDOM = 252

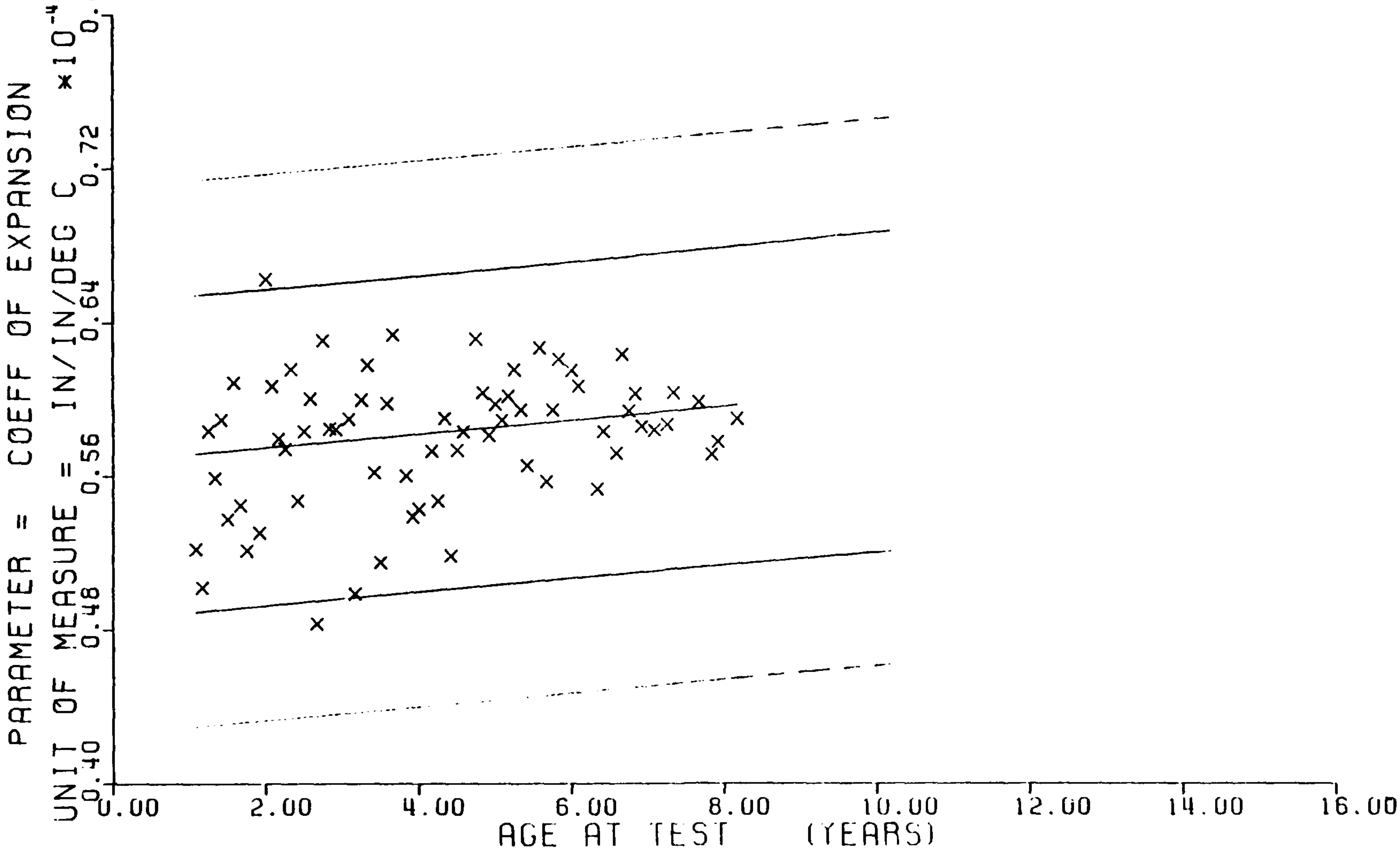
STORAGE CONDITIONS = AMB TEMP/RH   TEST CONDITIONS = AMB TEMP/RH



TCLE BELOW GLASS POINT, ANB-3066 (ANB P-POLYMER LINED CARTONS)

Figure 7-11

```
           Y  =  (( +5.6788427E-05 )  +  ( +2.9855715E-08 )  * X)
F  =  +7.1420159E+00     SIGNIFICANCE OF F  =  SIGNIFICANT        σT = +4.7823444E-06
R  =  +1.4181082E-01     SIGNIFICANCE OF R  =  SIGNIFICANT        SB = +1.1171643E-08
t  =  +2.6724550E+00     SIGNIFICANCE OF t  =  SIGNIFICANT        St = +4.7408098E-06
N  =     350               DEGREES OF FREEDOM  =    348
   STORAGE CONDITIONS = AMB TEMP/RH          TEST CONDITIONS = AMB TEMP/RH
```



TCLE BELOW GLASS POINT, ANB-3066 (ANT P-POLYMER LINED CARTONS)

Figure 7-12

Y = ((+9.1029603E-05) + (+3.4461360E-08) * X)

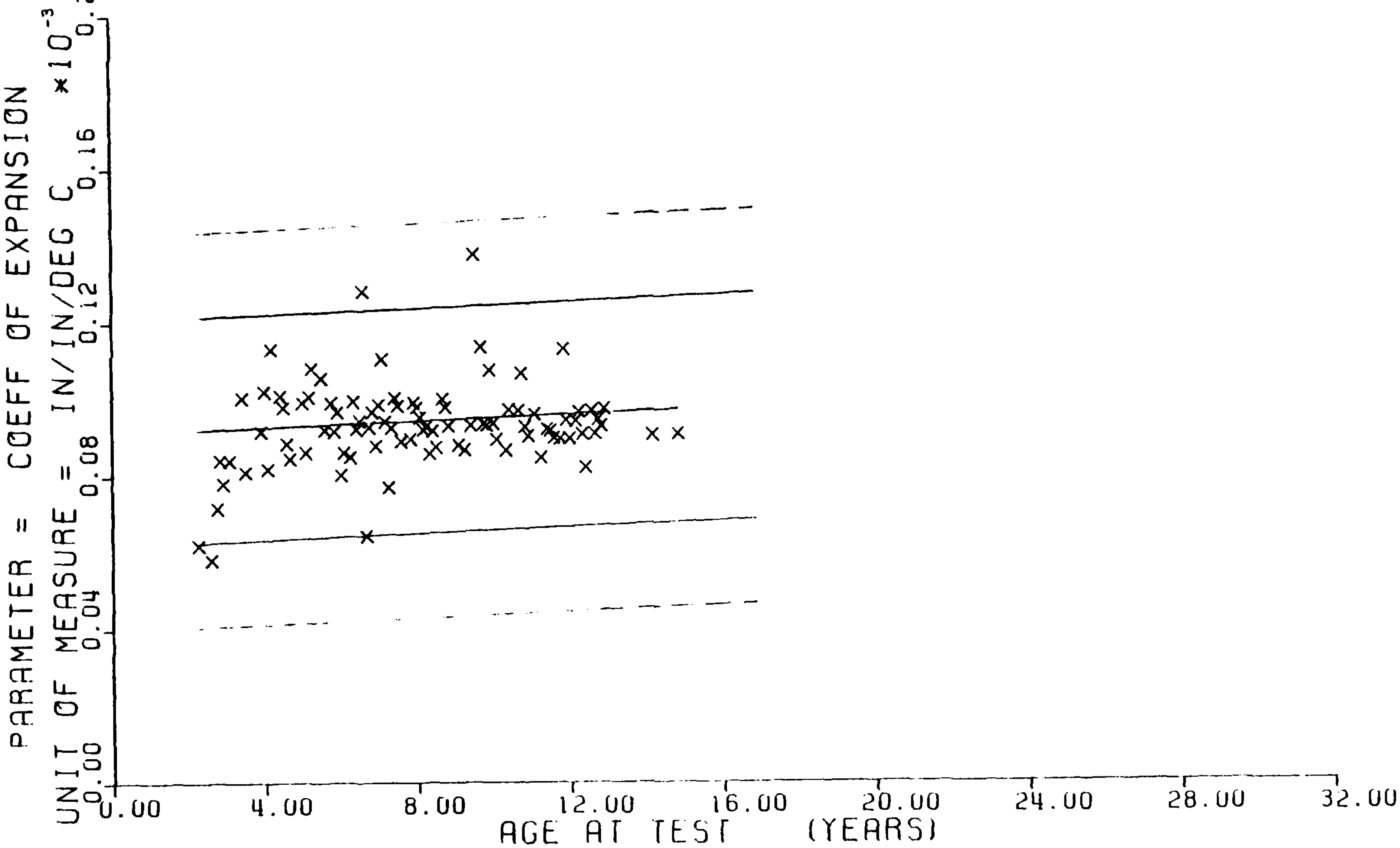
F = +2.6961047E+00 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_Y = +1.7186712E-05

R = +6.7847243E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT S_b = +2.0987661E-08

t = +1.6419819E+00 SIGNIFICANCE OF t = NOT SIGNIFICANT S_t = +1.7161809E-05

N = 585 DEGREES OF FREEDOM = 583

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



TCLE ABOVE GLASS POINT, ANB-3066 (ANB G-POLYMER UNLND CARTONS)

Figure 7-13

Y = ((+9.2356763E-05) + (+4.0988774E-08) * X)

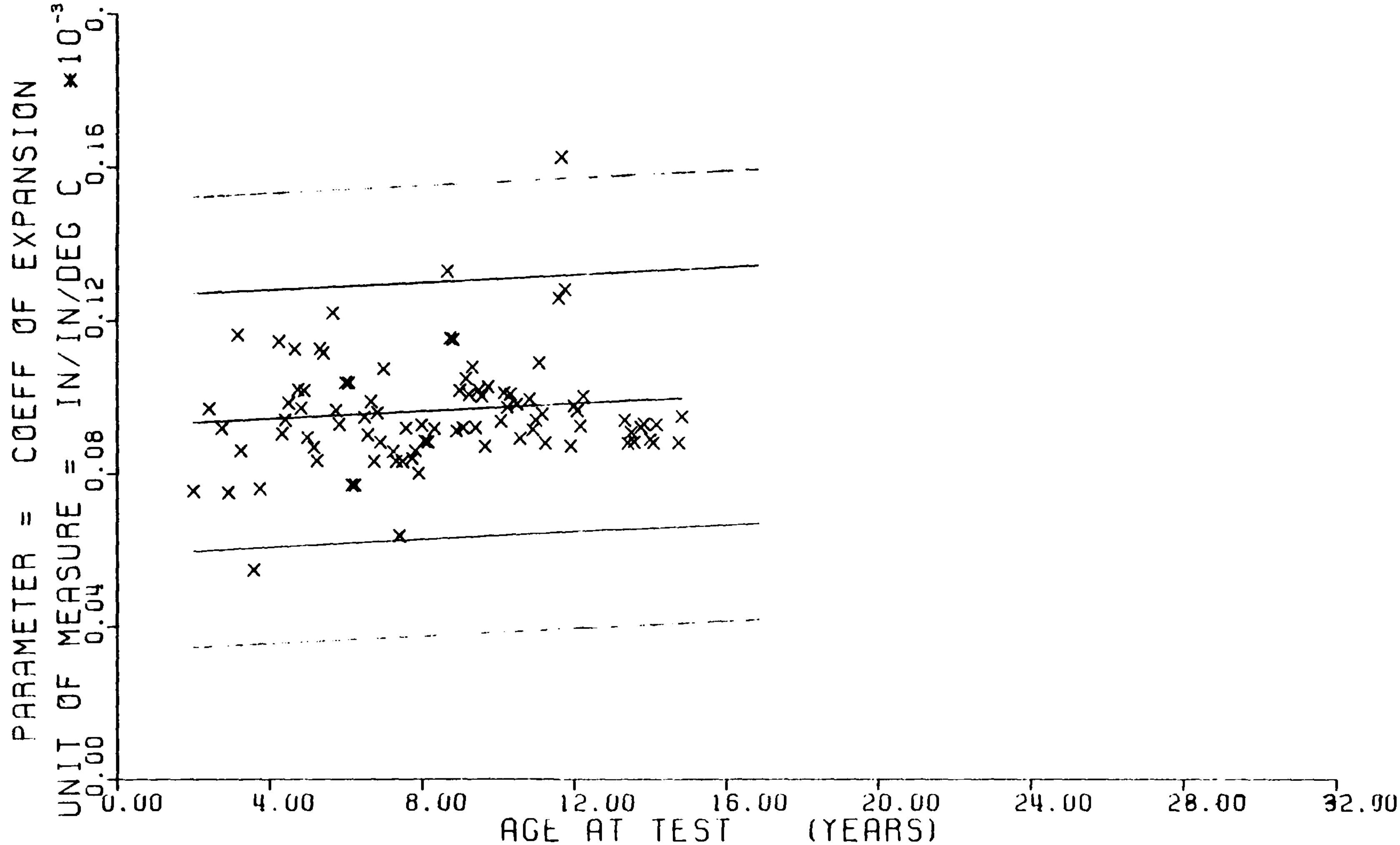
F = +3.0650936E+00 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_Y = +1.9653230E-05

R = +7.1709224E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT S_B = +2.3412245E-08

t = +1.7507408E+00 SIGNIFICANCE OF t = NOT SIGNIFICANT S_t = +1.9619156E-05

N = 595 DEGREES OF FREEDOM = 593

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



TCLE ABOVE GLASS POINT, ANB-3066 (ANB P-POLYMER UNLND CARTONS)

Figure 7-14

Y = ((+1.0833828E-04) + (-1.8926453E-07) * X)

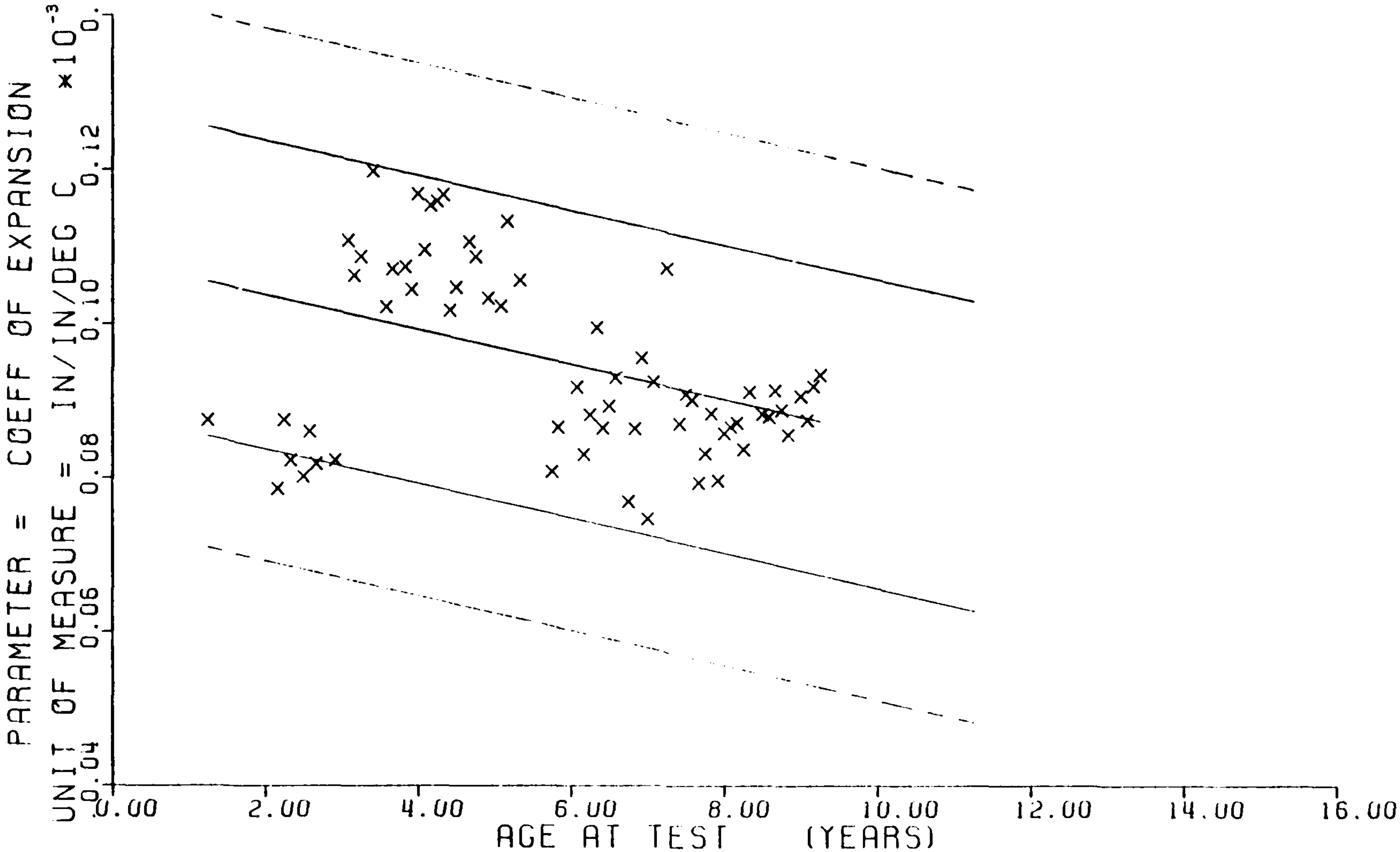
F = +6.7742733E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_T = +1.2489825E-05

R = -3.8940597E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +2.2995236E-08

t = +8.2305973E+00 SIGNIFICANCE OF t = SIGNIFICANT S_E = +1.1519122E-05

N = 381 DEGREES OF FREEDOM = 379

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



TCLE ABOVE GLASS POINT, ANB-3066 (ANT P-POLYMER UNLND CARTONS)

Figure 7-15

Y = ((+1.1806392E-04) + (-6.5291267E-08) × X)

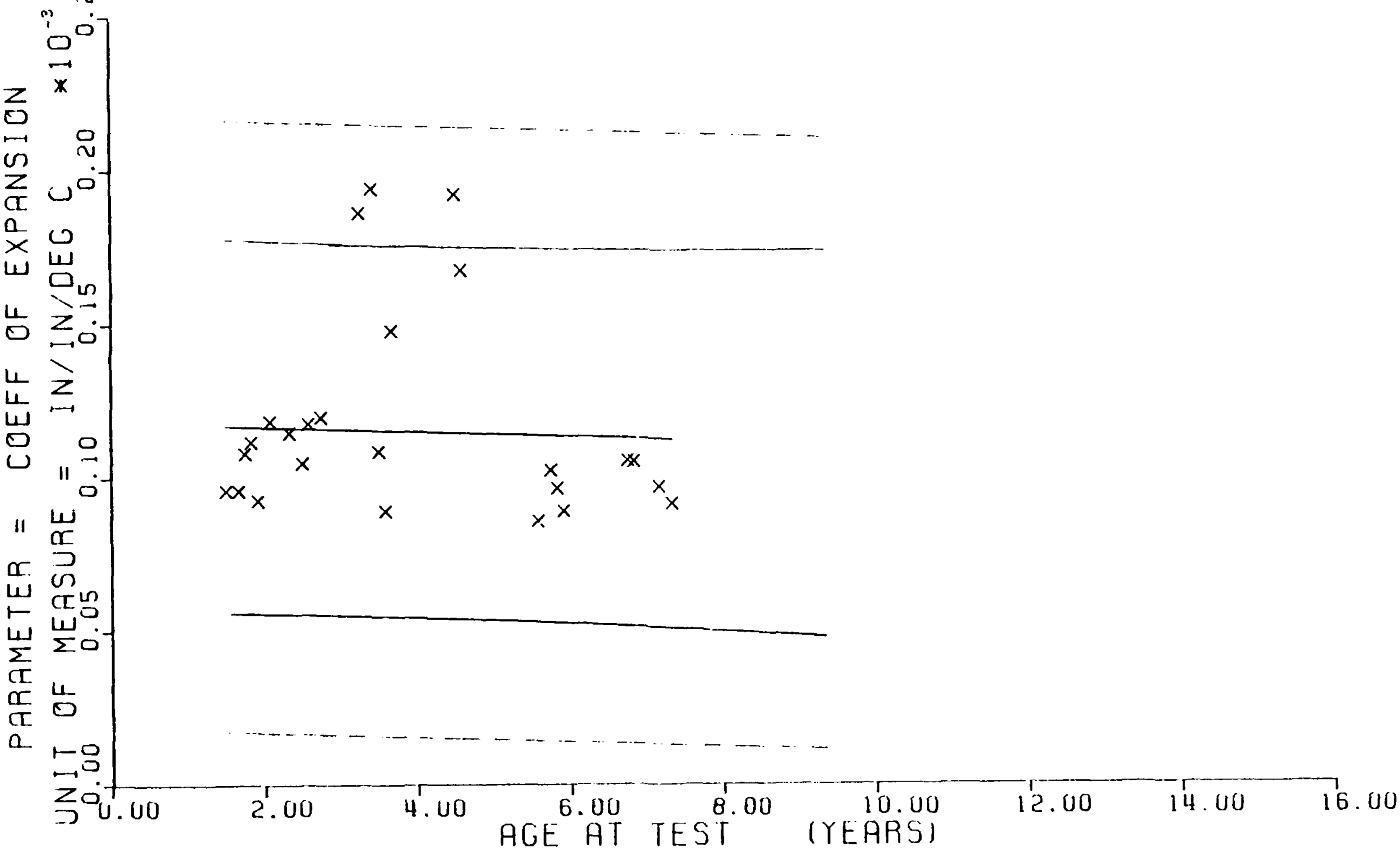
F = +2.2619214E-01 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_Y = +3.3028051E-05

R = -4.6810556E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT S_B = +1.3728286E-07

t = +4.7559661E-01 SIGNIFICANCE OF t = NOT SIGNIFICANT S_t = +3.3151613E-05

N = 105 DEGREES OF FREEDOM = 103

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



TCLE ABOVE GLASS POINT, ANB-3066 (ANB G-POLYMER LINED CARTONS)

Figure 7-16

Y = ((+1.1715343E-04) + (-2.2628040E-07) * X)

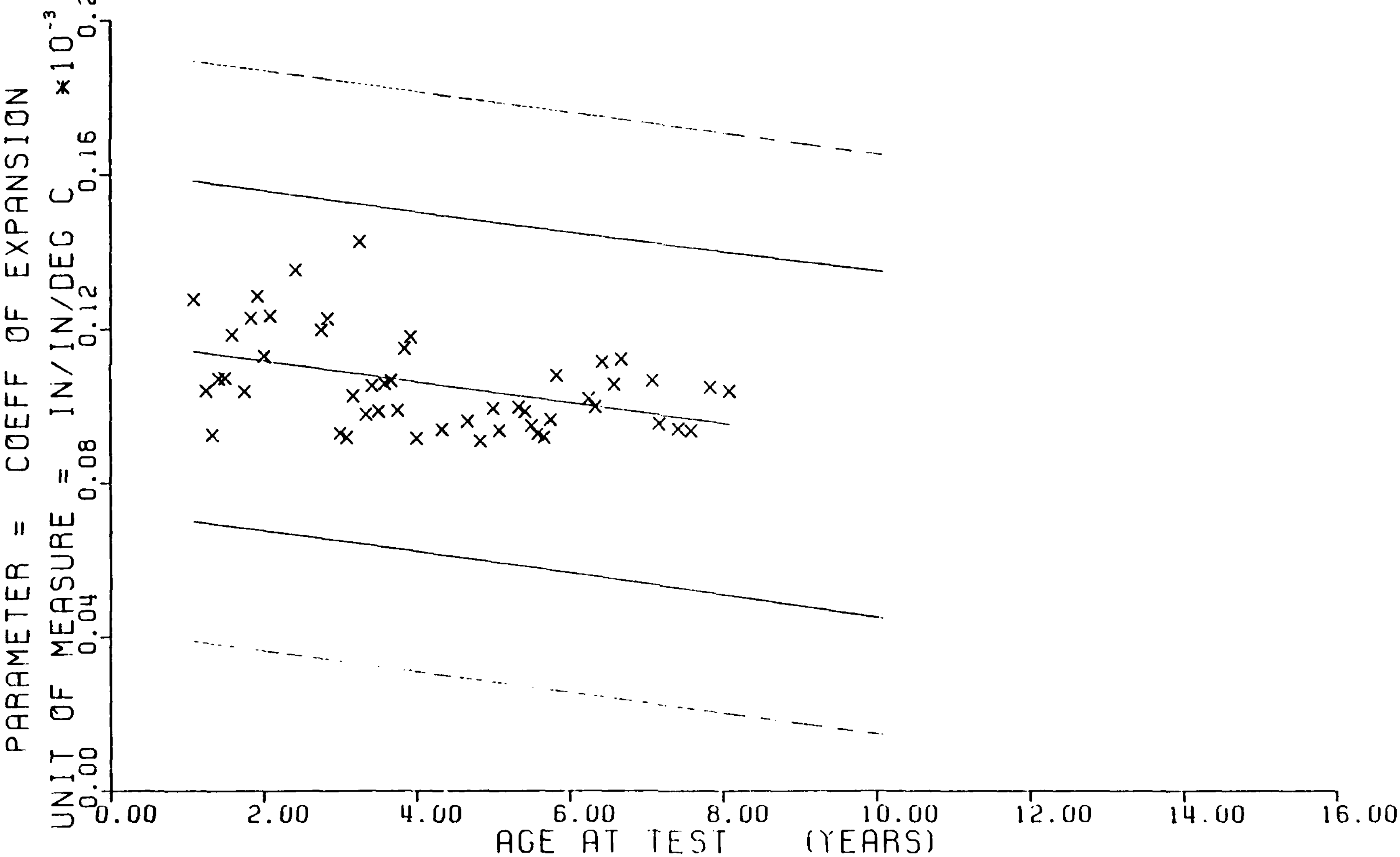
F = +1.0763398E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +2.5587466E-05

R = -2.0717752E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +6.6971907E-08

t = +3.2807619E+00 SIGNIFICANCE OF t = SIGNIFICANT S_t = +2.5084400E-05

N = 242 DEGREES OF FREEDOM = 240

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



ICLE ABOVE GLASS POINT, ANB-3066 (ANB P-POLYMER LINED CARTONS)

Figure 7-17

Y = ((+1.0272816E-04) + (-9.4950933E-08) * X)

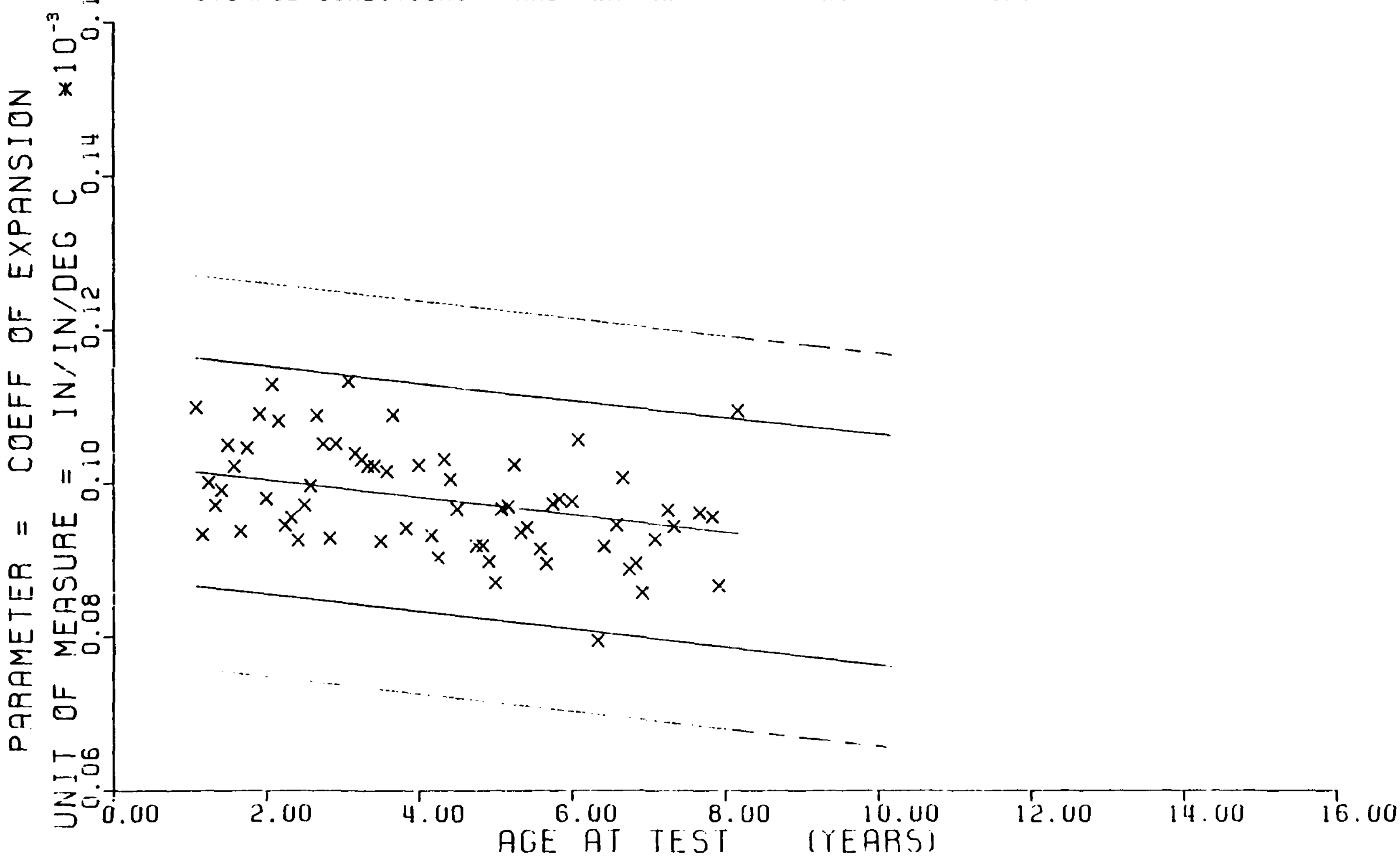
F = +2.2264939E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_T = +8.6033489E-06

R = -2.5357503E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +2.0122803E-08

t = +4.7185738E+00 SIGNIFICANCE OF t = SIGNIFICANT S_t = +8.5287490E-06

N = 326 DEGREES OF FREEDOM = 324

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



ICLE ABOVE GLASS POINT, ANB-3066 (ANT P-POLYMER LINED CARTONS)

Figure 7-18

SECTION VIII

CASE LINER BONDS

Cartons of propellant were lined with SD-851-2 liner/V45 rubber simulating motor conditions. In the preparation of the cartons, liner sometimes penetrated the propellant to a depth of 0.5 inch. Irregularities are most apparent on outer surfaces. Corners may be particularly affected by curvature of the insulation.

Liner color varies from a pale buff to deep buff or a deep pink which apparently develops from moisture plus anti-oxidant. In general, the pink liner tends to be sticky and strings out in tensile testing. Shear strength may be negligible.

OO-ALC has made an extensive statistical study of the constant load tensile and shear tests. Regressions for these data as well as other parameters are included in this report. Limited swell ratio and gel filler data on liner as well as insulation moisture were compared (Tables 8-8 to 8-10). A more detailed correlation is planned for the next report.

TABLE 8-1

STAGE 2 CONSTANT LOAD SHEAR REGRESSION DATA, G-POLYMER

The regression model used is of the form log Y = a + b(log X) where X = shear stress and Y = time to failure.

TEST PHASE B

Age (mo)	Lot	Motor	Intercept	Slope	n	r	1 min Stress	100 min Stress
22	60	AA21311	13.0701	-7.9684	12	-.973	43.676	24.505
25	59	AA21283	12.1143	-7.3717	12	-.951	43.989	23.553
29	58	AA21209	13.8537	-8.3308	11	-.977	46.022	26.478
32	49	AA21018	14.1541	-8.6622	6	-.954	43.053	25.300
35	53	AA21063	12.4473	-7.4627	12	-.915	46.552	25.115
37	55	AA21106	13.9609	-8.5201	12	-.982	43.510	25.343
38	52	AA21021	10.4349	-6.3359	12	-.817	44.355	21.443

TEST PHASE C

Age (mo)	Lot	Motor	Intercept	Slope	n	r	1 min Stress	100 min Stress
60	60	AA21294	11.2125	-7.2152	12	-.976	35.800	18.910
43	59	AA21282	11.1911	-6.9292	12	-.966	41.216	21.205
46	58	AA21234	16.1773	-10.136	12	-.994	39.447	25.044
52	53	AA21071	14.2785	-8.4681	12	-.975	48.545	28.181
56	55	AA21117	11.5434	-7.1340	12	-.975	41.504	21.764

TEST PHASE D

Age (mo)	Lot	Motor	Intercept	Slope	n	r	1 min Stress	100 min Stress
68	60	AA21321	5.02779	-3.2491	11	-.585	35.274	17.365
72	59	AA21260	33.7135	-2.8076	11	-.896	15.878	3.0792
82	58	AA21179	15.6875	-9.4493	11	-.996	45.726	28.087
83	52	AA21034	11.1826	-6.9763	11	-.964	40.081	20.713
83	55	AA21125	11.9056	-7.1665	11	-.982	43.251	27.933

TABLE 8-2

STAGE 2 CONSTANT LOAD SHEAR REGRESSION DATA, P-POLYMER

The regression model used is of the form log Y = a + b(log X) where X = shear stress and Y = time to failure.

TEST PHASE B

Age (mo)	Lot	Motor	Intercept	Slope	n	r	1 min Stress	100 min Stress
2	64	AA21417	13.2989	-7.9395	12	-.960	47.319	26.493
5	65	AA21388	13.9332	-8.7228	10	-.971	39.568	23.338
16	63	AA21367	8.69682	-5.3406	12	-.950	42.505	17.945
21	61	AA21322	13.2364	-8.5704	12	-.947	35.029	20.468
22	62	AA21329	14.7193	-8.7807	12	-.950	47.460	28.091
28	57	AA21223	17.4790	-10.932	8	-.924	39.054	25.677
37	51	AA21105	14.8923	-9.0240	12	-.972	44.698	26.832
37	54	AA21137	13.6749	-8.3896	12	-.921	42.656	24.637
38	56	AA21189	14.8535	-8.9330	12	-.982	46.001	27.471

TEST PHASE C

Age (mo)	Lot	Motor	Intercept	Slope	n	r	1 min Stress	100 min Stress
13	67	AA21465	19.9178	-11.331	12	-.958	57.253	38.132
14	66	AA21462	11.8533	-6.9955	12	-.871	49.561	25.659
15	71	AA21573	11.5156	-6.6743	11	-.925	53.133	26.651
17	69	AA21522	18.7595	-11.196	11	-.979	47.375	31.399
19	70	AA21559	12.0937	-6.8629	11	-.929	57.835	29.564
23	68	AA21493	16.7583	-9.6245	11	-.995	55.107	34.151
40	64	AA21436	11.1034	-6.5490	11	-.934	49.595	24.550
41	61	AA21306	12.2860	-7.5280	12	-.955	42.860	23.248
45	63	AA21360	10.1480	-6.6027	11	-.955	34.430	17.141
45	65	AA21389	11.2362	-6.4823	11	-.921	54.120	26.597
46	62	AA21343	12.5891	-7.8257	11	-.966	40.615	22.548
48	57	AA21211	11.5756	-7.3380	12	-.977	37.800	20.181
60	51	AA21101	13.7674	-8.6801	12	-.980	38.555	29.572
61	54	AA21140	13.3955	-8.2475	11	-.984	42.067	24.068
65	56	AA21173	10.8979	-6.1682	11	-.923	58.451	27.704

TEST PHASE D

Age (mo)	Lot	Motor	Intercept	Slope	n	r	1 min Stress	100 min Stress
20	72	AA21588	16.1158	-9.6000	11	-.970	47.723	29.539
22	71	AA21573	10.7962	-6.5785	11	-.939	43.764	21.732
38	69	AA21547	13.1198	-8.1812	11	-.995	40.147	22.866
40	70	AA21557	14.7159	-9.1255	11	-.989	40.985	24.743
42	66	AA21460	14.9358	-8.9486	11	-.965	46.672	27.897
42	67	AA21466	14.1850	-8.2125	11	-.993	53.364	30.459
46	68	AA21499	12.3799	-7.7255	11	-.991	40.038	22.059
67	61	AA21328	9.40889	-6.3683	11	-.993	30.023	14.568
67	64	AA21420	12.2083	-7.7312	11	-.985	37.940	20.912
69	63	AA21363	11.7702	-7.2822	11	-.992	41.332	21.961

TABLE 8-2 (cont)

STAGE 2 CONSTANT LOAD SHEAR REGRESSION DATA, P-POLYMER

TEST PHASE D

Age (mo)	Lot	Motor	Intercept	Slope	n	r	1 min Stress	100 min Stress
70	62	AA21345	11.2601	-7.1446	11	-.967	37.673	19.774
70	65	AA21388	10.2403	-6.6128	11	-.944	35.364	17.625
76	57	AA21201	12.8670	-7.9301	11	-.981	41.933	23.461
81	53	AA21070	12.3556	-7.6964	11	-.977	40.306	22.157
87	51	AA21086	11.1299	-6.9617	11	-.981	39.695	20.486
90	56	AA21181	12.3432	-7.3275	11	-.979	48.364	25.797
91	54	AA21083	12.5761	-7.7672	11	-.989	41.604	22.995

TABLE 8-3

STAGE 2 CONSTANT LOAD TENSILE REGRESSION DATA, G-POLYMER

The regression model used is of the form log Y = a + b(log X) where X = stress at rupture and Y = time to failure.

TEST PHASE B

Age (mo)	Lot	Motor	Intercept	Slope	n	r	1 min Stress	100 min Stress
26	60	AA21288	13.7487	-6.8986	12	-.871	98.391	50.471
27	59	AA21256	17.9335	-9.6728	11	-.936	71.450	44.335
28	58	AA21249	18.8035	-10.238	12	-.922	68.644	43.778
36	55	AA21133	22.3898	-12.392	12	-.953	64.093	44.199

TEST PHASE C

Age (mo)	Lot	Motor	Intercept	Slope	n	r	1 min Stress	100 min Stress
41	60	AA21317	22.0597	-13.145	12	-.982	47.668	33.580
45	58	AA21248	12.9768	-6.9177	12	-.737	75.143	38.617
45	59	AA21256	14.7715	-8.0956	12	-.815	66.776	37.807
53	53	AA21062	19.3288	-11.090	12	-.980	55.316	36.519
55	52	AA21036	14.3414	-8.7223	8	-.836	44.078	25.997
55	55	AA21128	20.7283	-11.669	12	-.949	59.751	40.267
56	52	AA21024	19.0582	-11.354	12	-.963	47.699	31.795

TEST PHASE D

Age (mo)	Lot	Motor	Intercept	Slope	n	r	1 min Stress	100 min Stress
70	60	AA21295	20.2605	-11.836	11	-.987	51.499	34.899
71	59	AA21283	22.8699	-13.552	11	-.991	48.703	34.672
80	58	AA21210	19.0608	-10.831	11	-.956	57.525	37.601
82	52	AA21048	16.4537	-9.8669	11	-.994	46.511	29.165
83	55	AA21121	17.2319	-10.533	11	-.963	43.251	27.933

TABLE 8-4

STAGE 2 CONSTANT LOAD TENSILE REGRESSION DATA, P-POLYMER

The regression model used is of the form log Y = a + b(log X) where X = stress at rupture and Y = time to failure.

TEST PHASE B

Age (mo)	Lot	Motor	Intercept	Slope	n	r	1 min Stress	100 min Stress
14	56	AA21166	22.2074	-12.675	10	-.833	56.509	39.294
14	64	AA21420	10.7429	-5.4052	12	-.802	97.171	41.449
17	65	AA21393	18.5944	-10.801	12	-.927	52.661	34.382
20	63	AA21360	18.4521	-10.654	12	-.944	53.947	35.014
22	62	AA21337	19.8863	-11.258	12	-.953	58.398	38.792
24	61	AA21305	16.3522	-9.1211	12	-.821	62.058	37.457
35	54	AA21156	27.0012	-15.383	12	-.955	56.925	42.197
39	51	AA21094	23.0185	-12.893	12	-.852	61.006	42.682

TEST PHASE C

Age (mo)	Lot	Motor	Intercept	Slope	n	r	1 min Stress	100 min Stress
14	69	AA21547	16.6397	-8.9140	11	-.734	73.569	43.886
16	67	AA21448	18.0061	-10.066	12	-.979	61.499	38.920
16	71	AA21581	12.6581	-6.1827	11	-.869	111.51	52.947
17	66	AA21441	18.6003	-10.044	12	-.931	71.100	44.952
23	70	AA21531	12.7410	-6.1702	10	-.601	116.13	55.055
30	68	AA21459	14.6537	-8.5349	11	-.857	52.108	30.379
40	61	AA21326	25.1976	-14.309	12	-.928	57.679	41.806
42	64	AA21417	22.9380	-12.465	11	-.962	69.216	47.836
44	65	AA21404	17.0212	-9.8910	10	-.929	54.335	33.012
47	62	AA21329	18.3478	-9.5702	11	-.954	82.637	51.073
50	57	AA21194	24.6502	-13.894	12	-.925	59.456	42.682
60	51	AA21084	23.0903	-13.139	12	-.939	57.191	40.283
61	54	AA21148	24.3077	-14.062	11	-.957	53.533	38.583
64	56	AA21184	15.9249	-8.6167	11	-.893	70.492	41.308

TEST PHASE D

Age (mo)	Lot	Motor	Intercept	Slope	n	r	1 min Stress	100 min Stress
38	67	AA21487	14.6186	-7.3336	11	-.875	98.481	52.558
41	69	AA21525	20.4166	-11.322	11	-.911	68.237	45.119
43	65	AA21568	19.5928	-10.586	11	-.945	70.923	45.905
43	68	AA21516	12.4913	-6.1117	11	-.947	110.62	52.072
46	66	AA21442	19.2808	-10.440	11	-.912	70.288	45.217
64	63	AA21379	13.0038	-6.8487	11	-.771	79.201	40.430
66	64	AA21433	17.4392	-9.2558	11	-.897	76.583	46.564
69	61	AA21310	17.0889	-10.125	11	-.932	48.732	30.923
69	65	AA21401	14.2516	-8.2269	11	-.918	53.989	30.846
71	62	AA21333	12.5348	-7.5255	11	-.938	46.306	25.112
76	57	AA21215	20.2346	-12.234	11	-.942	45.080	30.939
82	53	AA21057	16.7398	-9.8964	11	-.962	49.148	30.861

TABLE 8-4 (cont)

STAGE 2 CONSTANT LOAD TENSILE REGRESSION DATA, P-POLYMER

TEST PHASE D

Age (mo)	Lot	Motor	Intercept	Slope	n	r	1 min Stress	100 min Stress
85	51	AA21098	13.2229	-7.9487	11	-.910	46.083	25.313
89	54	AA21109	13.0395	-7.8006	11	-.950	46.945	26.014
92	56	AA21166	12.1908	-6.9698	11	-.973	56.118	28.983

TABLE 8-5

STAGE 3 CONSTANT LOAD SHEAR REGRESSION DATA, P-POLYMER

The regression model used is of the form log Y = a + b(log X) where X = shear stress and Y = time to failure.

Age (mo)	Lot	Motor	Intercept	Slope	n	r	1 min Stress	100 min Stress
			TEST PHASE 3					
19	321	8210041	13.1099	-7.6326	7	-.970	52.194	28.549
23	820	8200023	14.6180	-8.5983	8	-.985	50.130	29.342
26	819	8190028	13.5860	-8.0018	8	-.994	49.872	28.049
31	713	7130034	14.3034	-8.3827	8	-.987	50.852	29.357
38	711	7110051	8.41972	-5.2072	8	-.577	41.394	17.094
			TEST PHASE 4					
13	823	8230017	16.4565	-9.6976	12	-.989	49.771	30.955
18	822	8220007	13.4967	-8.0035	9	-.987	48.568	27.319
42	724	7240048	10.2445	-6.4912	8	-.982	37.863	18.626
			TEST PHASE 5					
36	713	7130044	15.5476	-9.1274	10	-.967	50.513	30.498
40	712	7120045	9.62801	-6.0349	12	-.995	39.390	18.364
44	711	7110035	12.2809	-7.2918	12	-.981	48.328	25.699
			TEST PHASE 6					
14	824	8240032	17.7952	-10.553	12	-.901	48.555	31.385
19	823	8230028	21.1021	-12.296	12	-.959	52.025	35.773
29	821	8210034	13.4603	-7.9625	12	-.987	49.029	27.497
33	820	8200030	12.8859	-7.7398	12	-.972	46.226	29.497
37	819	8190016	8.96705	-5.3234	12	-.767	48.359	20.360
			TEST PHASE 7					
17	825	8250011	13.0841	-7.5484	12	-.965	54.121	29.404
44	819	8190011	15.5395	-9.3563	12	-.977	45.798	27.996
48	713	7130002	13.1199	-8.0411	12	-.984	42.815	24.148
55	711	7110013	11.0248	-6.5053	12	-.975	49.515	24.395
56	712	7120003	15.5304	-9.3667	12	-.973	45.503	27.830
57	724	7240054	11.8401	-7.3638	12	-.993	40.539	21.691
83	712	7120013	16.4070	-9.8625	11	-.987	46.086	28.892
91	724	7240054	8.37928	-7.0650	11	-.966	29.108	11.343

TABLE 8-5 (cont)

STAGE 3 CONSTANT LOAD SHEAR REGRESSION DATA, P-POLYMER

Age (mo)	Lot	Motor	Intercept	Slope	n	r	1 min Stress	100 min Stress
				TEST PHASE 8				
20	826	8260007	21.6037	-12.380	11	-.897	47.565	33.266
31	824	8240028	16.8152	-10.020	11	-.978	47.666	30.103
37	823	8230008	20.5001	-12.112	11	-.972	49.265	33.683
42	822	8220014	9.91603	-6.3139	11	-.626	37.198	17.937
51	820	8200010	15.9720	-9.6165	11	-.992	45.803	28.374
				TEST PHASE 9				
17	827	8270011	18.4103	-11.003	11	-.981	47.127	31.009
27	825	8250044	17.1948	-10.095	11	-.975	50.511	32.008
51	821	8210025	14.4212	-8.5362	11	-.980	48.912	28.518
60	819	8190006	12.6020	-7.5430	11	-.994	46.846	25.441
64	713	7130002	13.5782	-8.3439	7	-.988	42.394	24.413
70	712	7120013	11.5089	-7.3055	11	-.978	37.616	20.026
71	711	7110009	11.8551	-7.4025	11	-.995	39.948	21.445
				TEST PHASE A				
31	826	8260015	16.8348	-9.7178	11	-.987	53.997	33.617
44	824	8240015	15.4307	-8.9740	11	-.985	52.418	31.377
53	822	8220027	12.0410	-7.2048	11	-.988	46.907	24.754
63	820	8200002	11.9315	-6.9638	11	-.989	51.539	26.616
78	724	7240048	-.11147	-.26039	11	-.011	.37317	+.8E-9
				TEST PHASE B				
30	827	8270015	15.8682	-9.5560	11	-.910	45.767	28.265
44	825	8250022	20.1053	-12.027	10	-.951	46.961	32.021
56	823	8230008	18.5872	-11.022	11	-.977	48.575	31.985
64	821	8210034	12.8413	-7.7737	11	-.999	44.864	24.809
71	819	8190038	11.9626	-7.1999	11	-.996	45.868	24.195
82	711	7110051	12.0442	-7.3969	11	-.977	42.490	22.798
				TEST PHASE C				
45	826	8260007	16.4749	-9.8431	11	-.974	47.179	29.550
52	825	8250013	19.5806	-11.705	11	-.972	47.085	31.770
65	822	8220036	13.8631	-8.2141	11	-.997	48.722	27.813
75	820	8200023	13.4959	-8.1893	11	-.990	44.462	25.338

TABLE 8-5 (cont)

STAGE 3 CONSTANT LOAD SHEAR REGRESSION DATA, P-POLYMER

TEST PHASE D

Age (mo)	Lot	Motor	Intercept	Slope	n	r	1 min Stress	100 min Stress
63	824	8240023	13.2894	-7.6100	11	-.969	55.760	30.444
67	823	8230028	15.2913	-8.8622	10	-.987	53.142	31.605
77	821	8210019	10.9339	-6.4095	11	-.992	50.803	24.766
84	819	8190038	11.4046	-6.7231	11	-.988	49.696	25.052
89	713	7130005	9.98445	-5.9224	11	-.967	48.515	22.293
96	711	7110040	10.4116	-6.3070	11	-.997	44.752	21.563

TABLE 8-6

STAGE 3 CONSTANT LOAD TENSILE REGRESSION DATA, P-POLYMER

The regression model used is of the form log Y = a + b(log X) where X = stress at rupture and Y = time to failure.

Age (mo)	Lot	Motor	Intercept	Slope	n	r	1 min Stress	100 min Stress
			TEST PHASE 3					
21	821	8210003	13.1818	-6.2723	8	-.422	126.36	60.637
26	820	8200002	38.2547	-20.942	8	-.885	67.092	53.848
29	819	8190001	15.8395	-7.9918	8	-.843	95.937	53.917
32	713	7130005	20.2442	-10.700	8	-.991	77.965	50.698
37	712	7120008	19.6676	-10.424	8	-.968	77.038	49.523
38	711	7110035	16.8353	-8.4005	8	-.718	100.95	58.345
			TEST PHASE 4					
15	823	8230002	26.1409	-13.928	9	-.976	75.309	54.107
18	822	8220022	19.5167	-10.212	10	-.950	81.488	51.910
44	724	7240038	19.9856	-11.558	12	-.985	53.595	35.982
			TEST PHASE 5					
38	713	7130005	20.8163	-11.297	12	-.941	69.594	46.296
41	712	7120016	12.7292	-6.9208	12	-.833	69.066	35.504
45	711	7110009	17.1434	-9.5384	12	-.892	62.705	38.692
			TEST PHASE 6					
18	824	8240007	18.1508	-9.3510	12	-.940	87.310	53.356
21	823	8230021	22.1575	-11.484	12	-.948	84.987	56.912
31	821	8210015	31.6598	-16.991	12	-.950	72.994	50.665
35	820	8200014	19.1153	-10.265	12	-.854	72.820	46.495
40	819	8190001	23.8491	-12.517	12	-.957	80.428	55.669
			TEST PHASE 7					
16	825	8250022	16.7463	-8.6629	11	-.822	85.725	50.378
43	819	8190038	18.1624	-9.9765	12	-.966	66.147	41.691
48	713	7130018	19.8043	-10.159	12	-.822	88.999	56.562
50	712	7120036	15.0582	-7.9836	12	-.951	76.936	43.213
55	711	7110048	15.7529	-8.4999	12	-.807	71.333	41.495
57	724	7240019	16.9016	-10.005	12	-.974	48.895	30.358

AD-A120 429 PROPELLANT SURVEILLANCE REPORT ANB-3066 PROPELLANT(U) 3/3
OGDEN AIR LOGISTICS CENTER HILL AFB UT PROPELLANT
ANALYSIS LAB E M DALABA AUG 82 MANPA-473(82)

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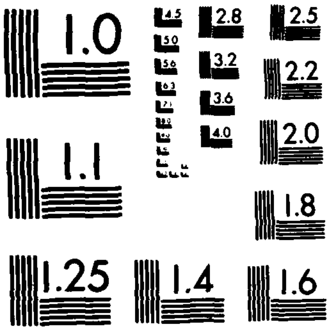
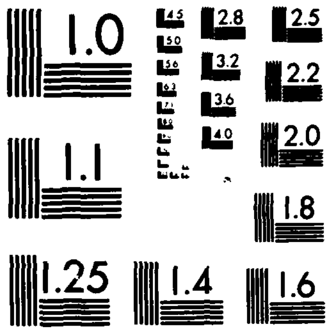


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



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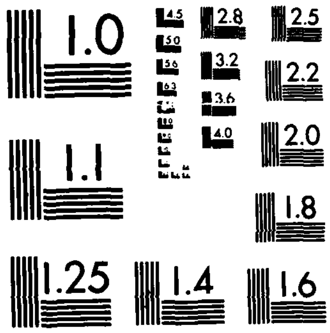
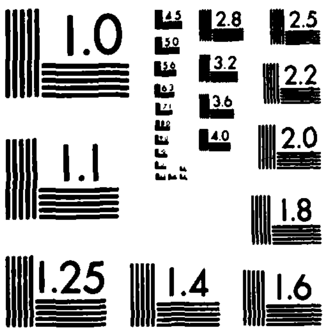
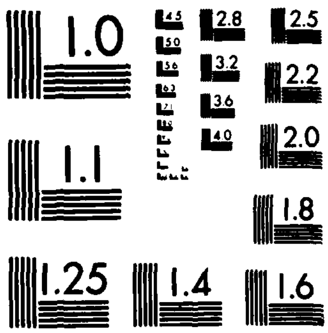
NATIONAL BUREAU OF STANDARDS-1963-A



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

TABLE 8-6 (cont)

STAGE 3 CONSTANT LOAD TENSILE REGRESSION DATA, P-POLYMER

TEST PHASE 8

Age (mo)	Lot	Motor	Intercept	Slope	n	r	1 min Stress	100 min Stress
16	826	8260032	17.1240	-8.8007	11	-.902	88.257	52.299
29	824	8240042	13.6789	-6.8911	11	-.837	96.610	49.521
35	823	8230031	18.0888	-9.5898	11	-.942	76.959	47.611
41	822	8220030	17.9088	-9.4096	11	-.864	80.029	49.056
49	820	8200037	16.9598	-8.6612	11	-.969	90.811	53.361

TEST PHASE 9

Age (mo)	Lot	Motor	Intercept	Slope	n	r	1 min Stress	100 min Stress
17	827	8270017	15.3113	-7.7680	11	-.843	93.555	51.713
33	825	8250013	12.8859	-6.5158	11	-.782	94.980	46.848
53	821	8210009	17.9556	-9.4548	11	-.934	79.269	48.705
60	819	8190021	22.4346	-12.313	11	-.937	66.368	45.660
66	712	7120045	16.9328	-9.9502	11	-.985	50.321	31.678
71	711	7110040	26.3446	-14.385	11	-.961	67.382	49.249

TEST PHASE A

Age (mo)	Lot	Motor	Intercept	Slope	n	r	1 min Stress	100 min Stress
26	826	8260041	16.8034	-8.7733	11	-.746	82.278	48.677
45	824	8240023	15.7004	-7.9573	11	-.670	93.990	52.692
51	822	8220045	20.7236	-11.146	11	-.916	72.318	47.843
63	820	8200021	16.2570	-7.9983	11	-.798	107.79	60.606
82	724	7240019	10.6739	-6.5243	11	-.871	43.254	21.354

TEST PHASE B

Age (mo)	Lot	Motor	Intercept	Slope	n	r	1 min Stress	100 min Stress
30	827	8270013	28.2432	-15.092	11	-.953	74.363	54.807
42	825	8250037	21.7257	-11.168	11	-.978	88.159	58.370
56	823	8230017	24.1691	-12.654	11	-.925	81.273	56.481
65	821	8210015	25.6292	-13.542	11	-.984	78.097	55.583
74	819	8190016	22.7572	-12.400	11	-.937	68.432	47.203
84	711	7110013	21.8461	-12.110	11	-.992	63.681	43.536

TEST PHASE C

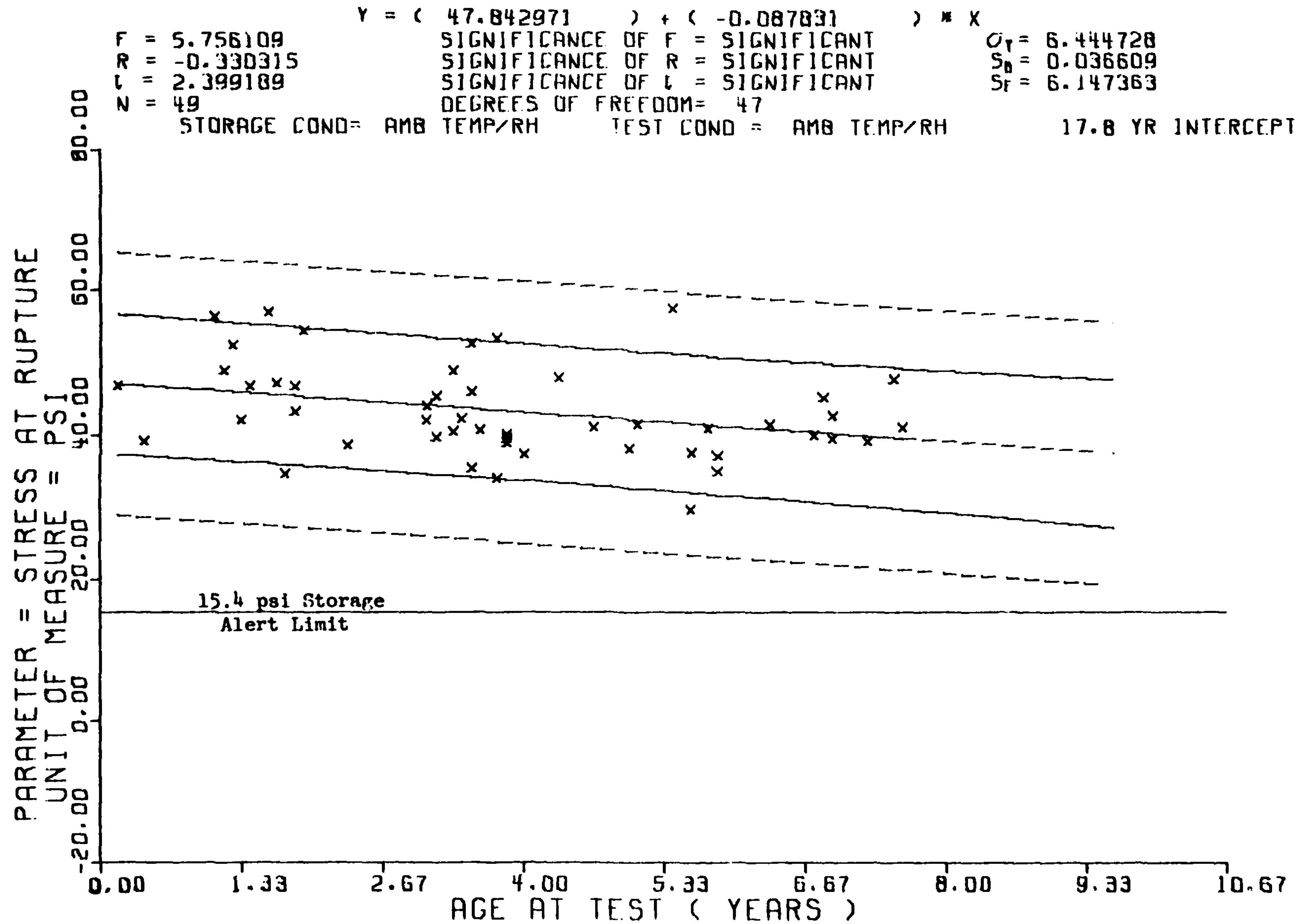
Age (mo)	Lot	Motor	Intercept	Slope	n	r	1 min Stress	100 min Stress
40	826	8260036	22.7023	-11.555	11	-.952	92.191	61.888
50	825	8250025	21.3375	-11.372	11	-.961	75.210	50.166
67	822	8220022	16.7785	-8.6984	11	-.871	84.903	50.003
76	820	8200014	21.1417	-11.610	11	-.932	66.209	44.530
86	712	7120029	17.7009	-9.7182	11	-.947	66.284	41.267
92	724	7240043	15.4176	-9.4967	11	-.965	42.021	25.874

TABLE 8-6 (cont)

STAGE 3 CONSTANT LOAD TENSILE REGRESSION DATA, P-POLYMER

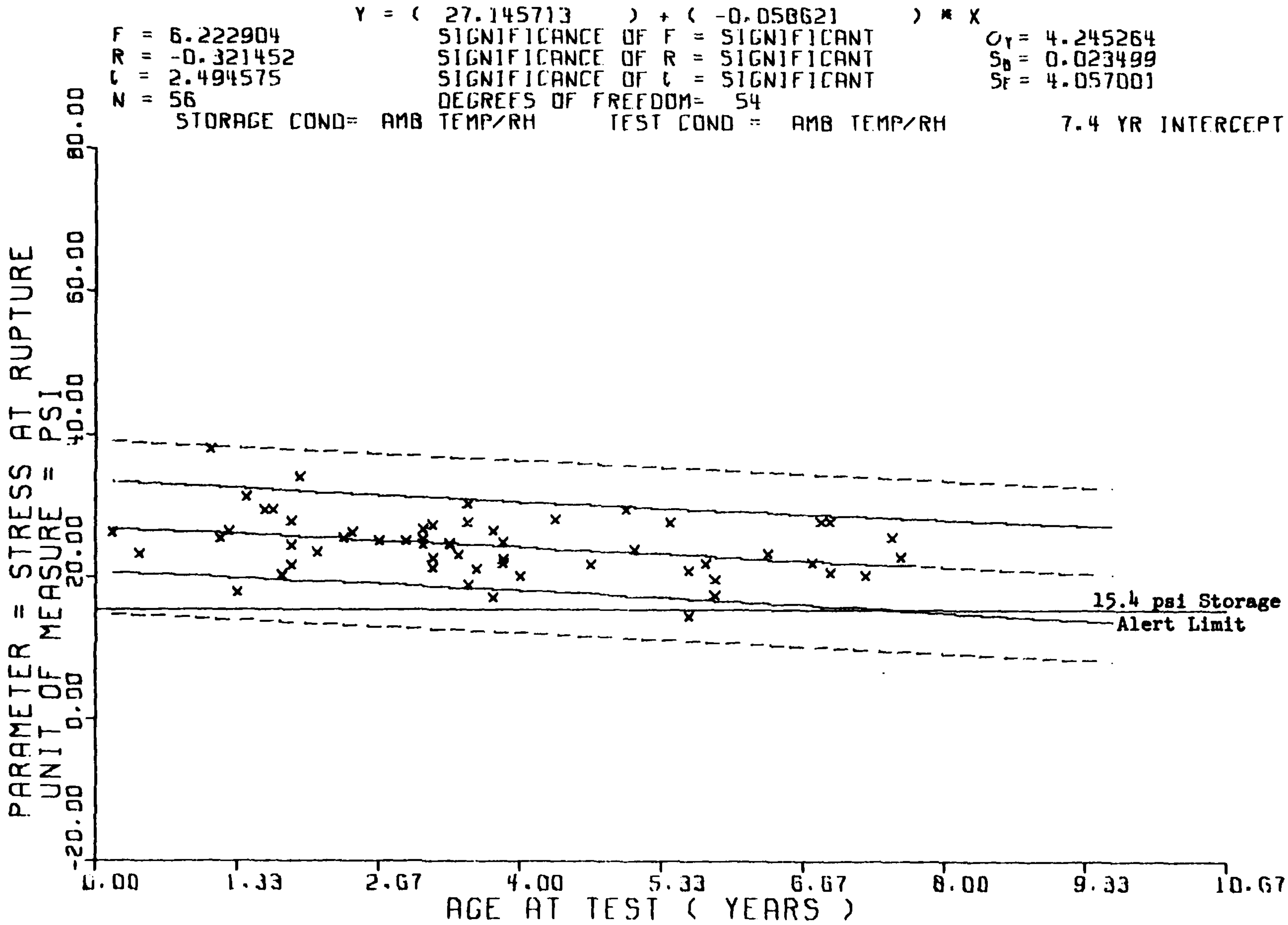
TEST PHASE D

Age (mo)	Lot	Motor	Intercept	Slope	n	r	1 min Stress	100 min Stress
60	824	8240042	27.2071	-14.777	11	-.969	69.375	50.799
69	823	8230002	26.6223	-14.521	11	-.984	68.135	49.618
79	821	8210003	18.6244	-9.7026	11	-.964	83.084	51.688
86	819	8190006	22.2807	-12.643	11	-.983	57.849	40.189
88	713	7130036	20.2615	-11.584	11	-.974	56.123	37.712
96	711	7110013	17.9228	-9.9707	11	-.974	62.737	40.272



STAGE 2 ONE MINUTE CONSTANT LOAD SHEAR, TEST PHASE B POLYMER G EXCLUDED

Figure 8-1



STAGE 2 CONSTANT LOAD SHEAR. 100 MINUTE TO RUPTURE. ALL PHASES AND POLYMERS

Figure 8-2

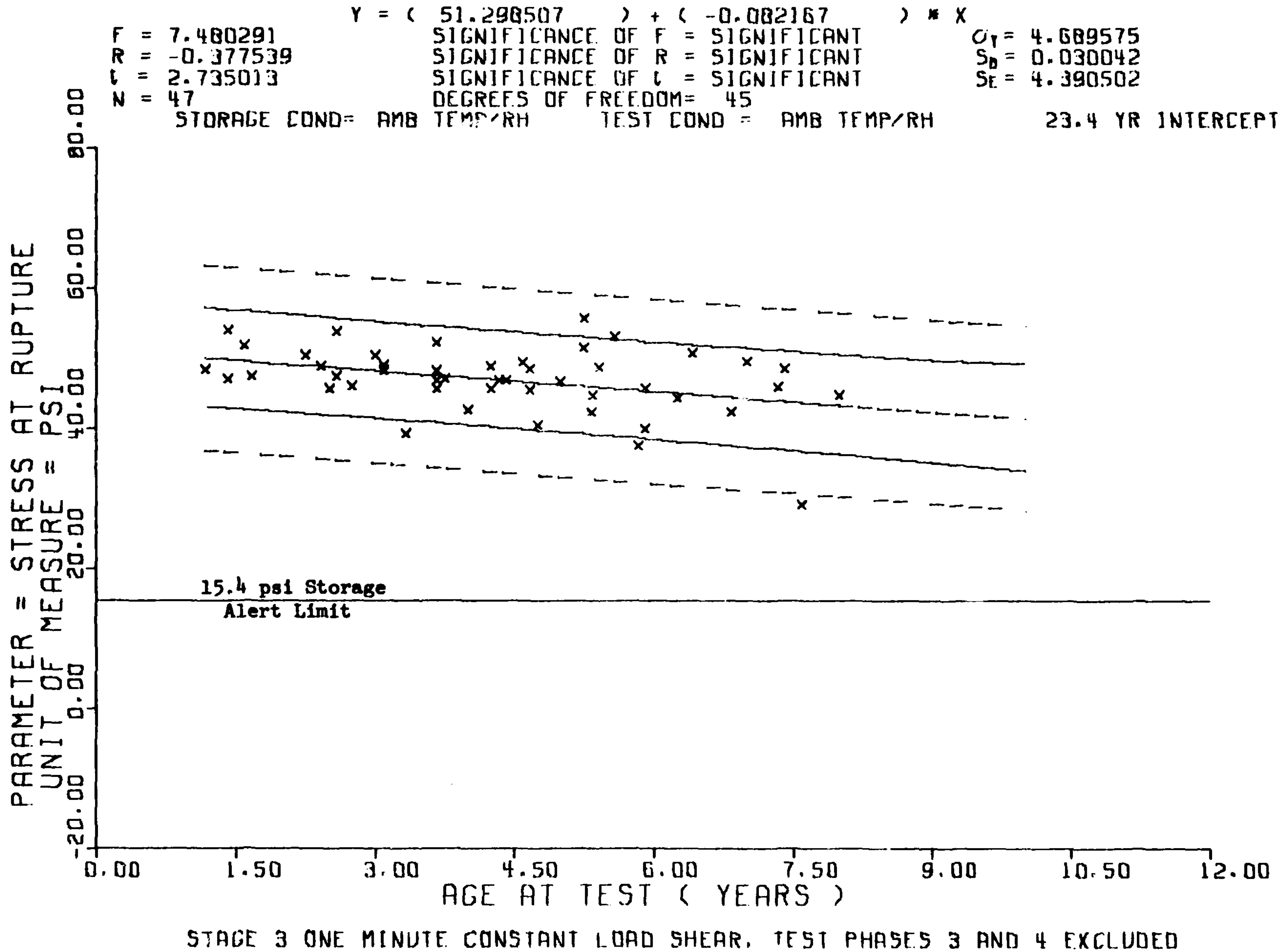
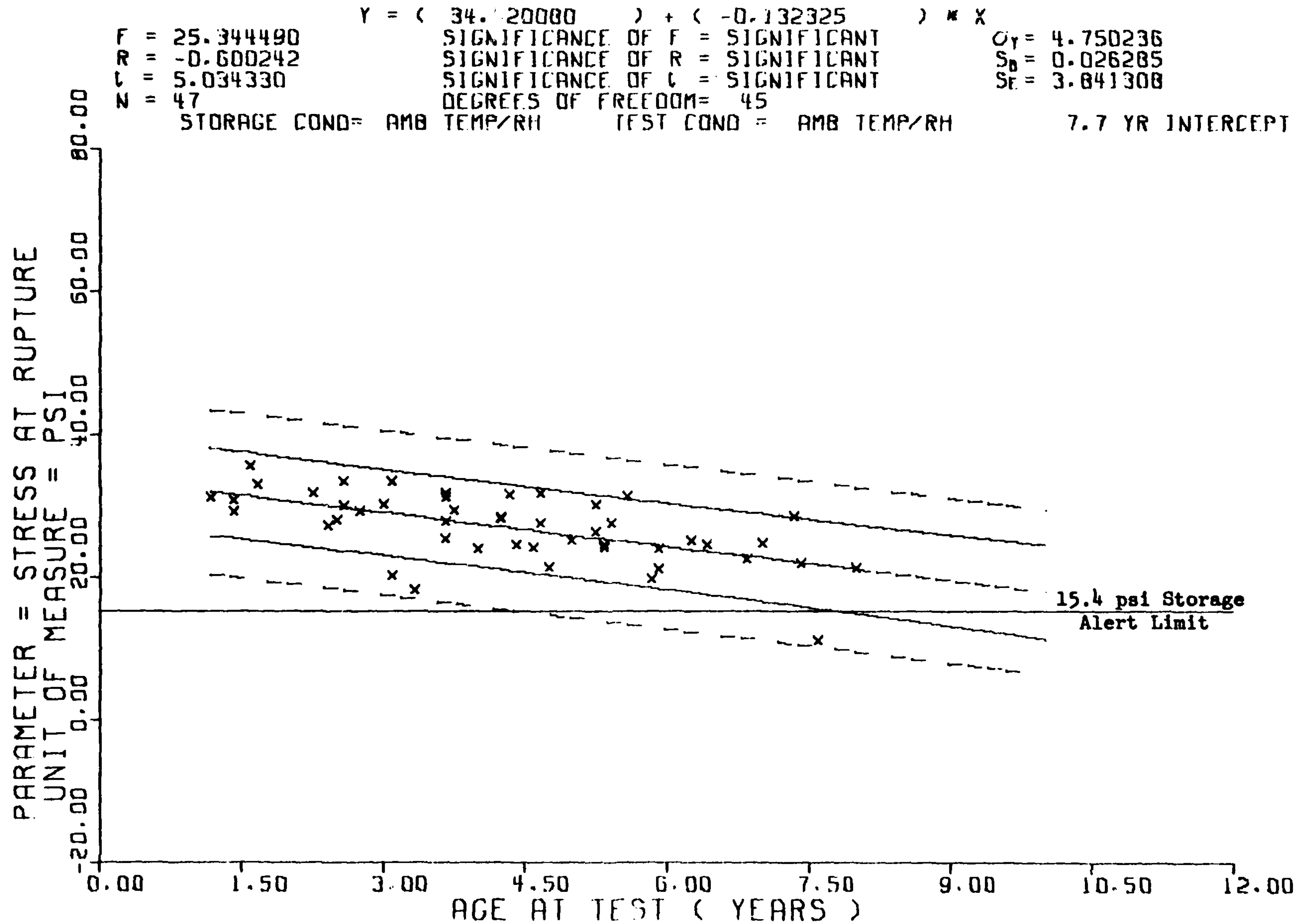

Y = (51.298507) + (-0.082167) * X
F = 7.480291
R = -0.377539
t = 2.735013
N = 47
SIGNIFICANCE OF F = SIGNIFICANT
SIGNIFICANCE OF R = SIGNIFICANT
SIGNIFICANCE OF t = SIGNIFICANT
DEGREES OF FREEDOM= 45
σT = 4.689575
Sb = 0.030042
SE = 4.390502
STORAGE COND= AMB TEMP/RH
TEST COND = AMB TEMP/RH
23.4 YR INTERCEPT
PARAMETER = STRESS AT RUPTURE
UNIT OF MEASURE = PSI
80.00
60.00
40.00
20.00
0.00
-20.00
15.4 psi Storage
Alert Limit
0.00
1.50
3.00
4.50
6.00
7.50
9.00
10.50
12.00
AGE AT TEST (YEARS)
STAGE 3 ONE MINUTE CONSTANT LOAD SHEAR, TEST PHASES 3 AND 4 EXCLUDED

Figure 8-3



STAGE 3 100 MINUTE CONSTANT LOAD SHEAR, TEST PHASES 3 AND 4 EXCLUDED

Figure 8-4

Y = (68.845458) + (-0.235256) * X

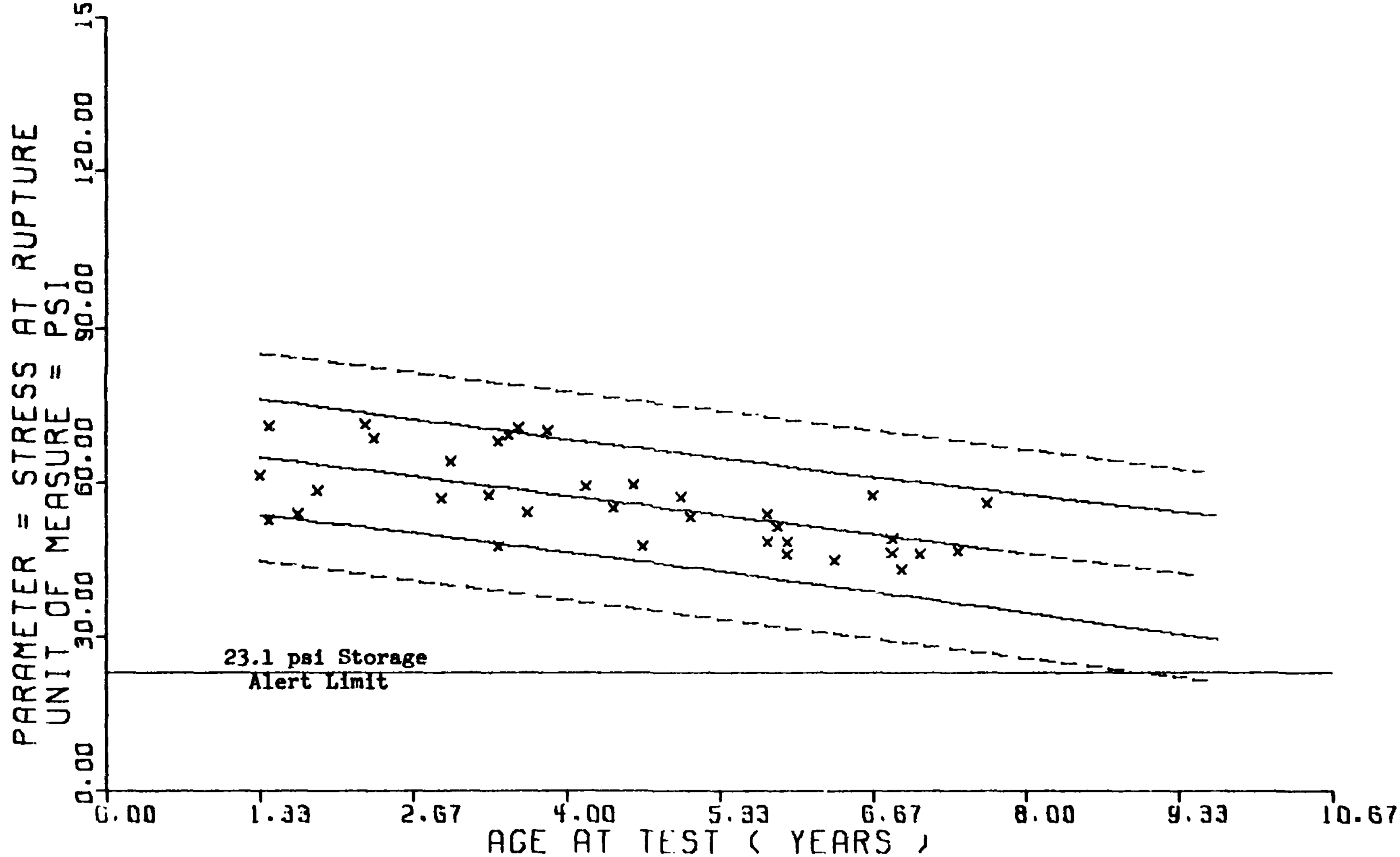
F = 21.897964 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = 8.568828

R = -0.631573 SIGNIFICANCE OF R = SIGNIFICANT S_b = 0.050273

t = 4.679525 SIGNIFICANCE OF t = SIGNIFICANT S_F = 6.743461

N = 35 DEGREES OF FREEDOM= 33

STORAGE COND= AMB TEMP/RH TEST COND = AMB TEMP/RH 11.6 YR INTERCEPT



STAGE 2 ONE MINUTE CONSTANT LOAD TENSILE. ALL PHASES AND POLYMERS INCLUDED

Figure 8-5

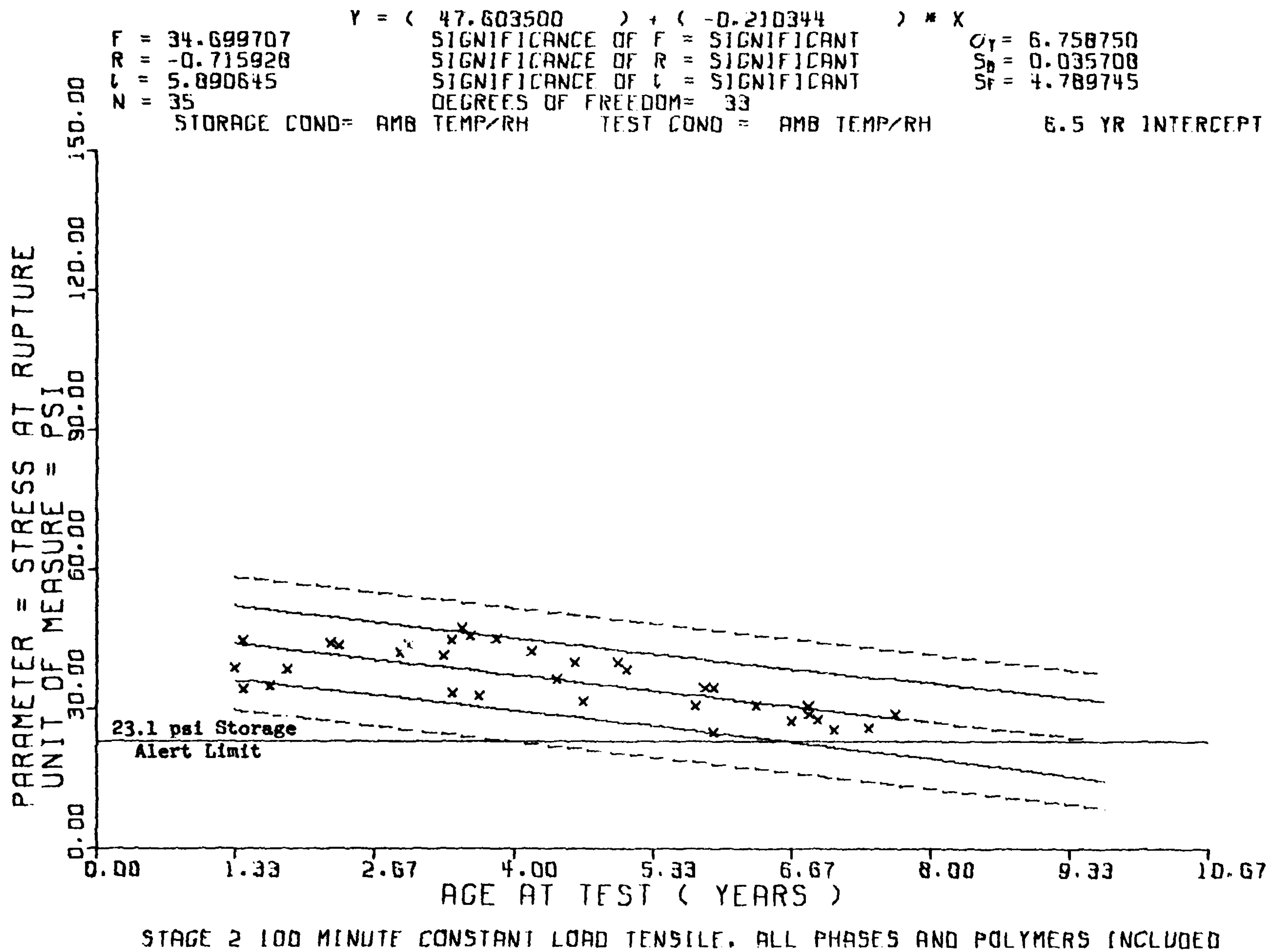
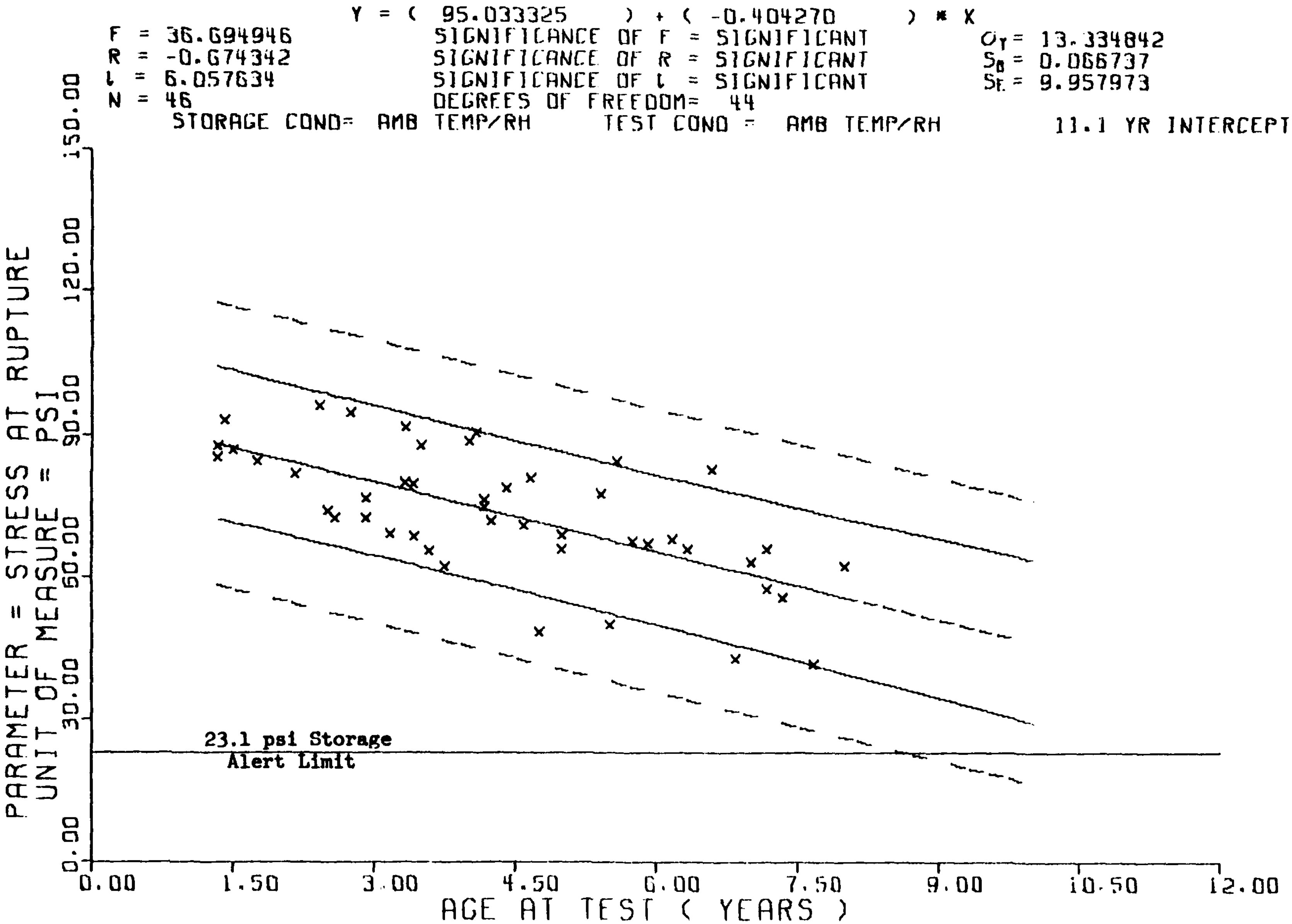
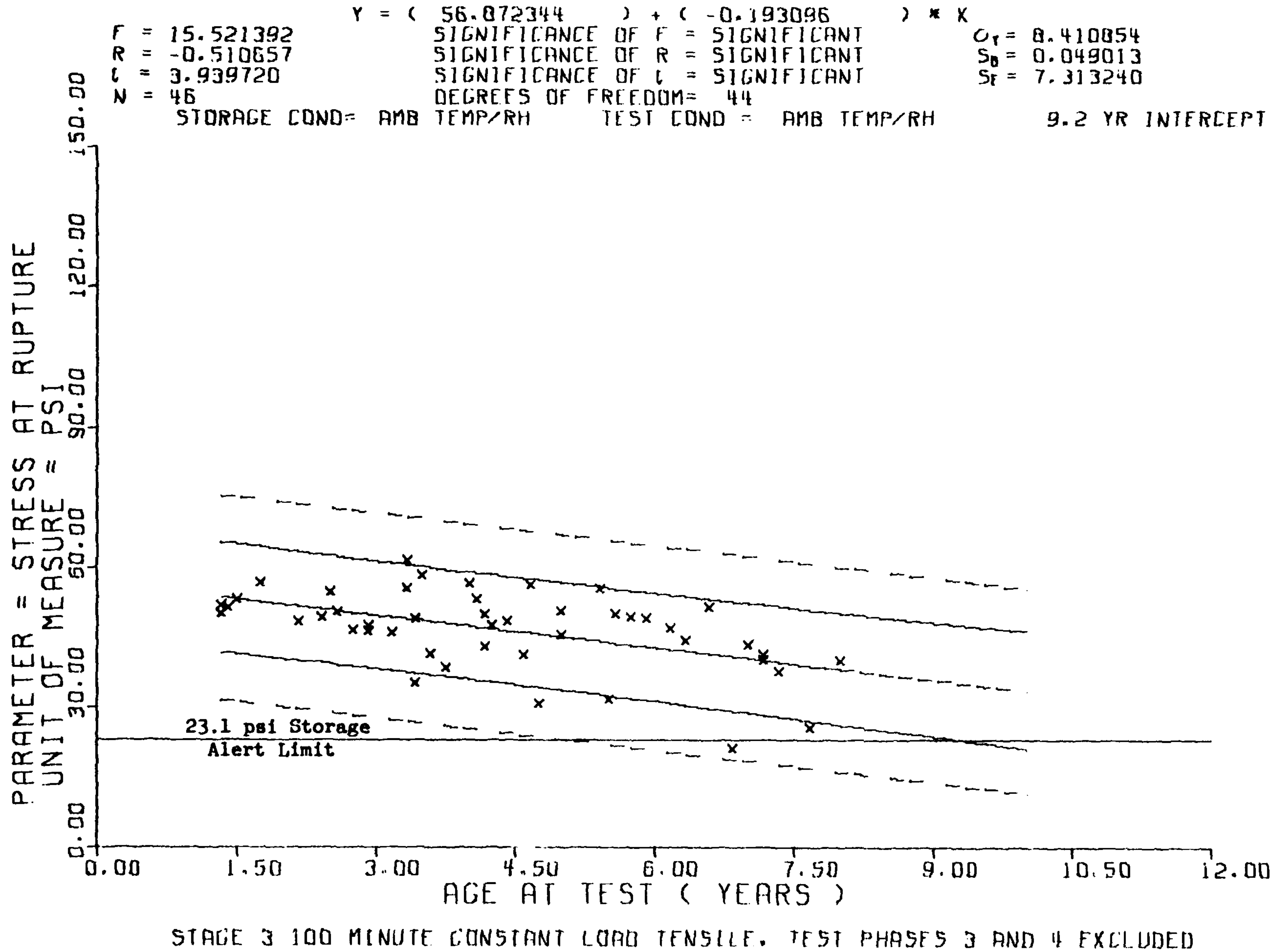

Y = (47.603500) + (-0.210344) * X
F = 34.699707
R = -0.715928
t = 5.890645
N = 35
SIGNIFICANCE OF F = SIGNIFICANT
SIGNIFICANCE OF R = SIGNIFICANT
SIGNIFICANCE OF t = SIGNIFICANT
DEGREES OF FREEDOM= 33
σY = 6.758750
Sb = 0.035708
Sr = 4.789745
STORAGE COND= AMB TEMP/RH
TEST COND = AMB TEMP/RH
6.5 YR INTERCEPT
PARAMETER = STRESS AT RUPTURE
UNIT OF MEASURE = PSI
0.00
30.00
60.00
90.00
120.00
150.00
23.1 psi Storage
Alert Limit
0.00
1.33
2.67
4.00
5.33
6.67
8.00
9.33
10.67
AGE AT TEST (YEARS)
STAGE 2 100 MINUTE CONSTANT LOAD TENSILE, ALL PHASES AND POLYMERS INCLUDED

Figure 8-6



STAGE 3 ONE MINUTE CONSTANT LOAD TENSILE. TEST PHASES 3 AND 4 EXCLUDED

Figure 8-7



Y = (56.872344) + (-0.193096) * X
F = 15.521392
R = -0.510657
t = 3.939720
N = 46
SIGNIFICANCE OF F = SIGNIFICANT
SIGNIFICANCE OF R = SIGNIFICANT
SIGNIFICANCE OF t = SIGNIFICANT
DEGREES OF FREEDOM= 44
σT = 8.410854
Sb = 0.049013
St = 7.313240
STORAGE COND= AMB TEMP/RH
TEST COND = AMB TEMP/RH
9.2 YR INTERCEPT
PARAMETER = STRESS AT RUPTURE
UNIT OF MEASURE = PSI
0.00
30.00
60.00
90.00
120.00
150.00
23.1 psi Storage
Alert Limit
0.00
1.50
3.00
4.50
6.00
7.50
9.00
10.50
12.00
AGE AT TEST (YEARS)
STAGE 3 100 MINUTE CONSTANT LOAD TENSILE. TEST PHASES 3 AND 4 EXCLUDED

Figure 8-8

TABLE 8-7

MULTIPLE REGRESSION DATA FOR CONSTANT
LOAD SHEAR AND CONSTANT LOAD TENSILE TESTS

The regression model used is of the form $\log Y = a + b_1 \log X_1 + b_2 X_2$ where Y = failure time in minutes, X_1 = stress in psi, and X_2 = age in months.

	Multiple Regression Data			
	Stage 2		Stage 3	
	Shear	Tensile	Shear	Tensile
a	11.598	17.857	14.267	18.967
b_1	-6.7647	-9.5112	-8.1641	-9.5285
b_2	-0.0098532	-0.018132	-0.010473	-0.021174
N	562	585	519	519
$\sum (X_2)^2$	1584026	1632940	1632850	1652971
$\sum X_2$	26630	28004	26928	26999
S_e	0.73635	0.83416	0.71579	0.95210
r^2	0.68456	0.69560	0.75344	0.61229
K	1.712	1.711	1.715	1.715

CHART 1. Five Percent Casebond Failure During Transportation and Handling. Carton testing indicates a five percent probability of failure if the indicated psi alert limits are sustained for the time corresponding to a selected age.

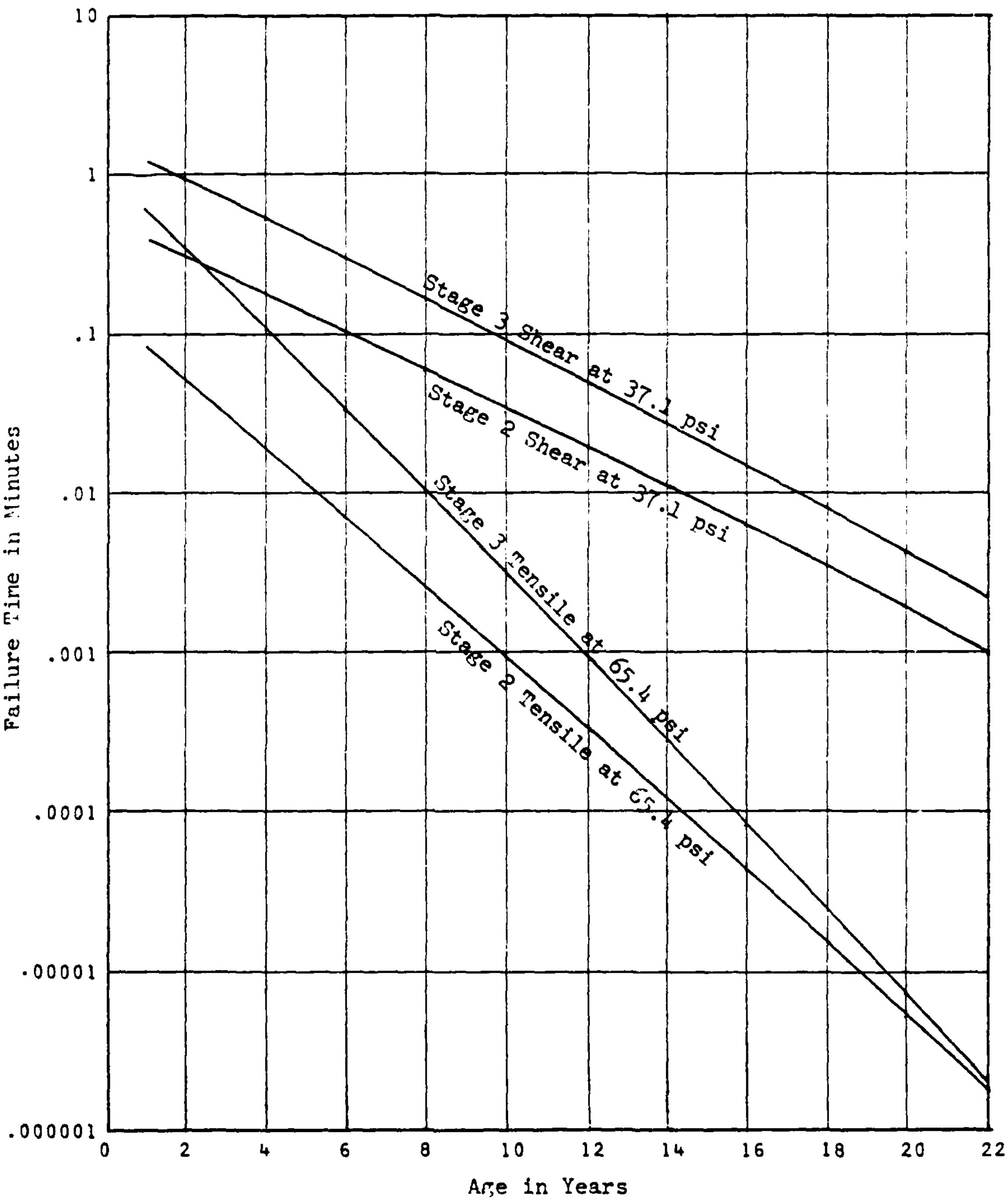


CHART 2. Five Percent Casebond Failure During Booster Flight. Carton testing indicates a five percent probability of failure if the indicated psi alert load limits are sustained for the time corresponding to a selected age.

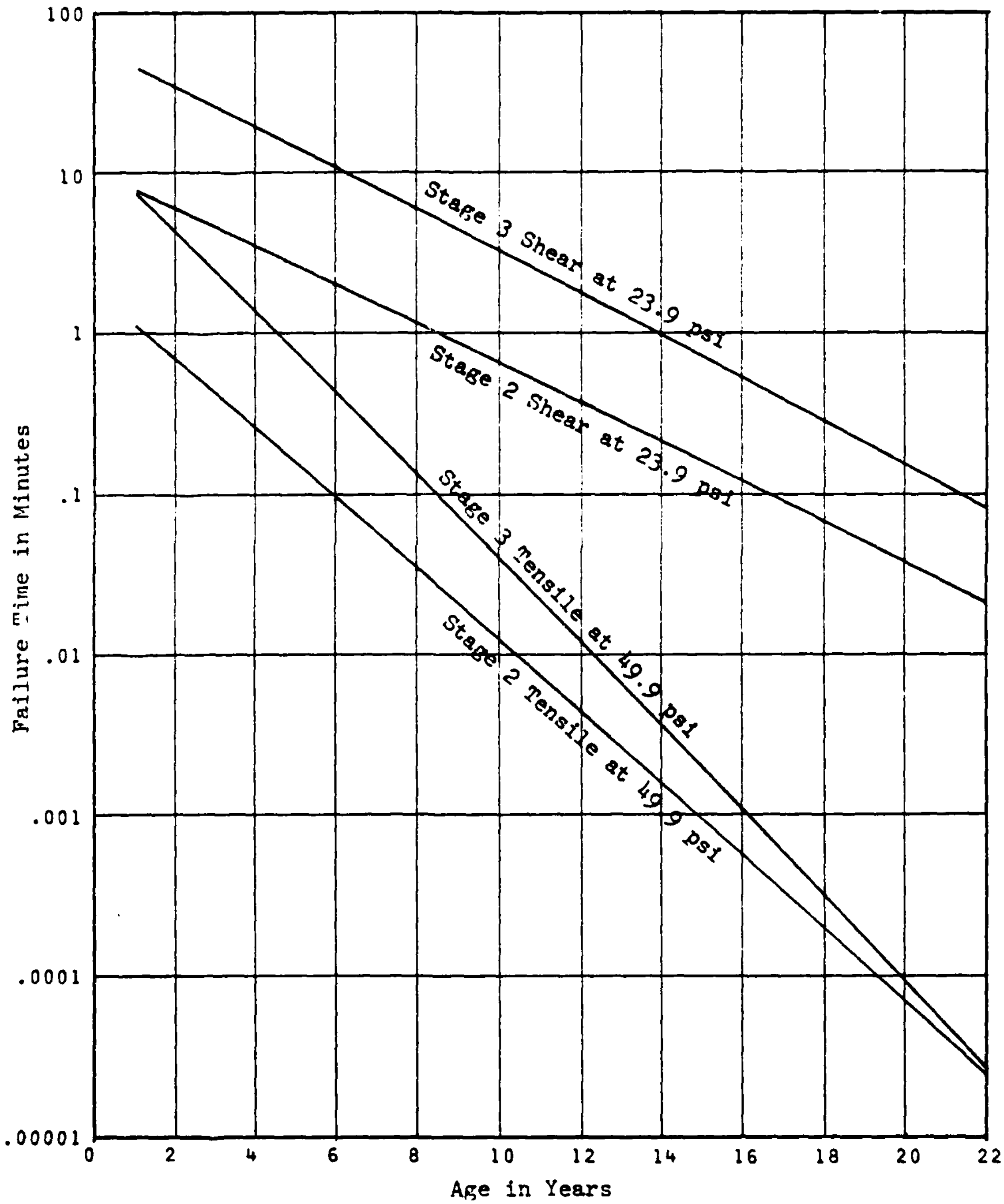


CHART 3. Five Percent Casebond Failure During Storage. Carton testing indicates a five percent probability of failure if the indicated psi alert load limits are sustained for the time corresponding to a selected age.

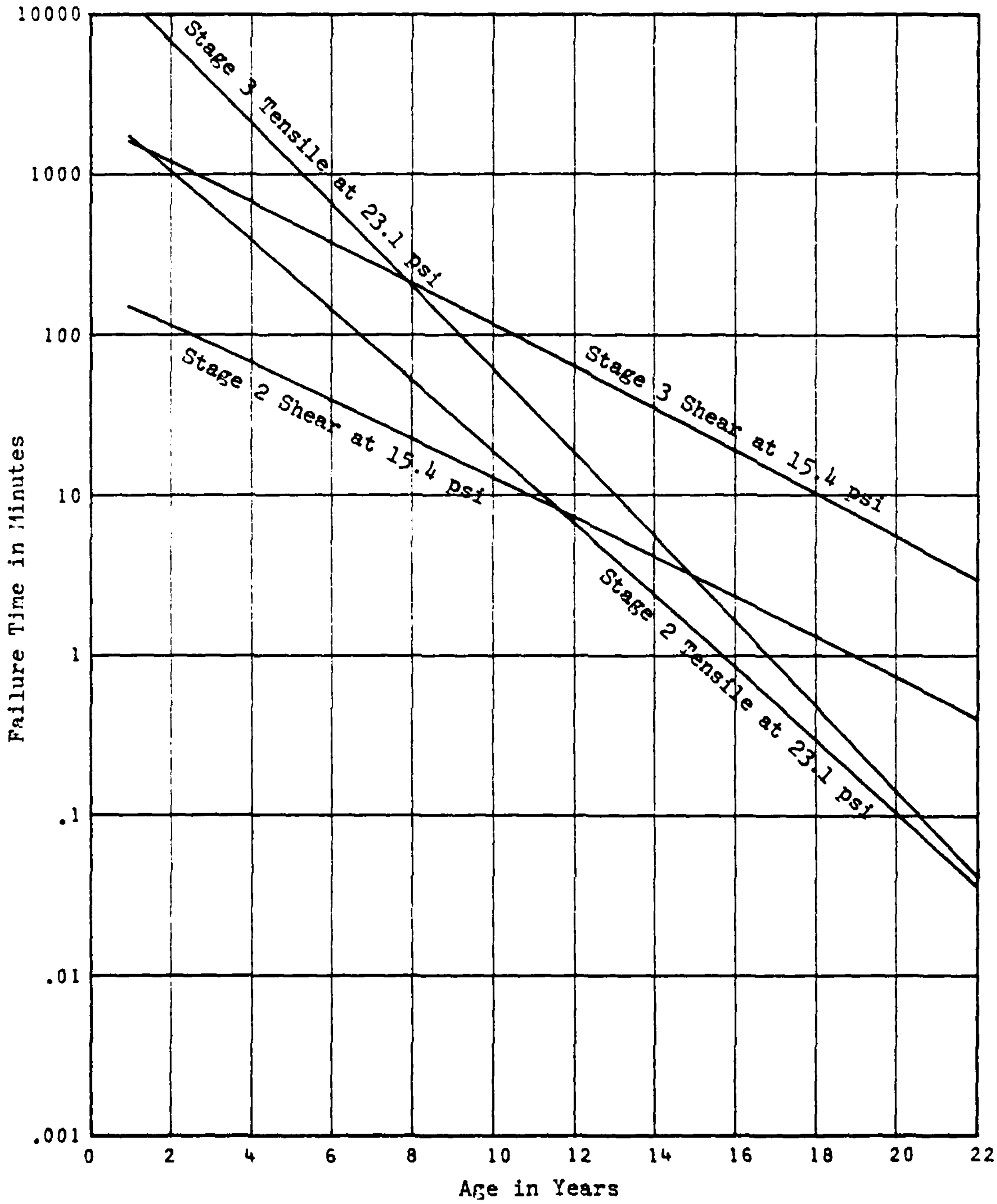


CHART 4. Fifty Percent Casebond Failure During Transportation and Handling. Carton testing indicates a fifty percent probability of failure if the indicated psi alert limits are sustained for the time corresponding to a selected age.

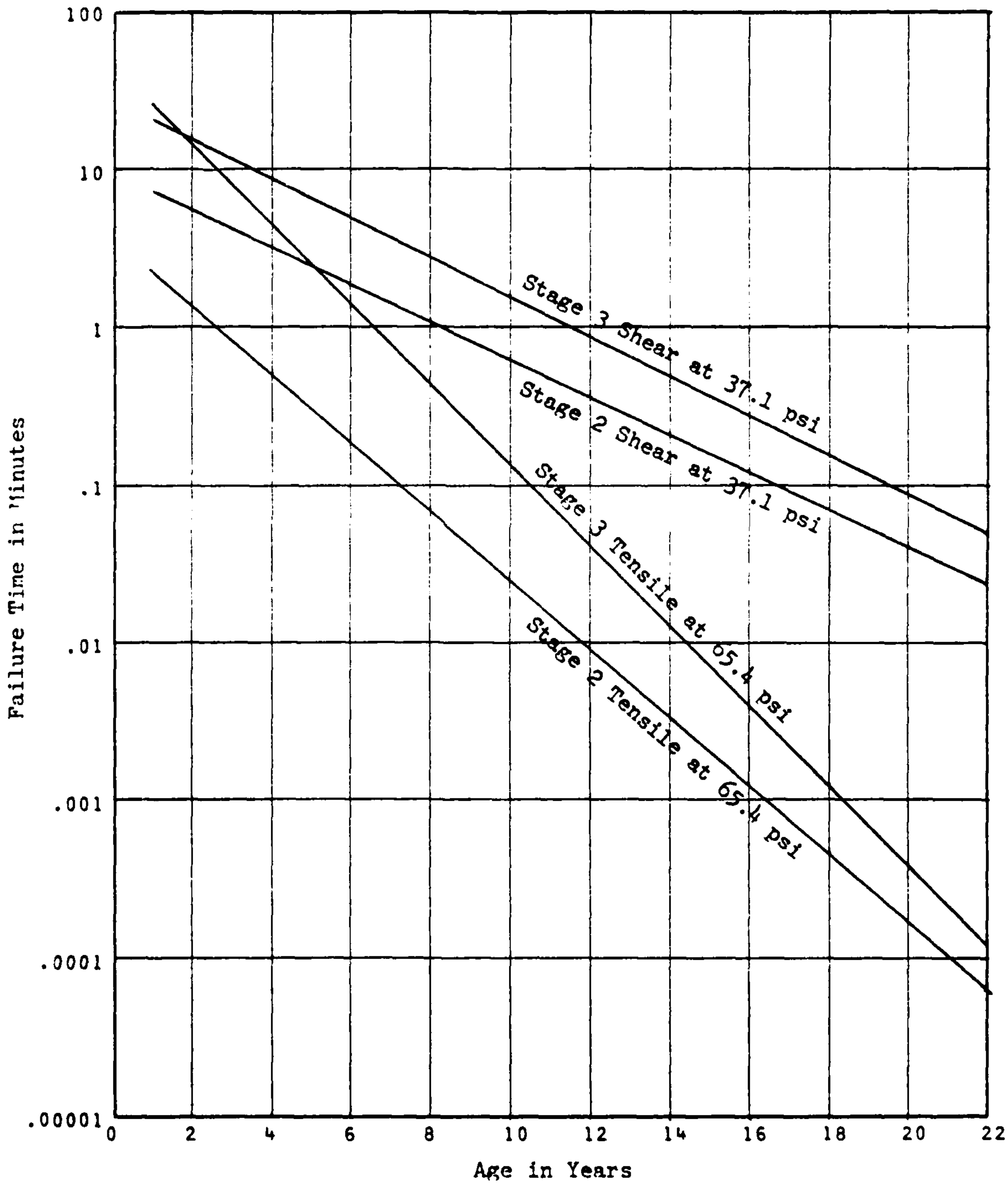


CHART 5. Fifty Percent Casebond Failure During Booster Flight. Carton testing indicates a fifty percent probability of failure if the indicated psi alert load limits are sustained for the time corresponding to a selected age.

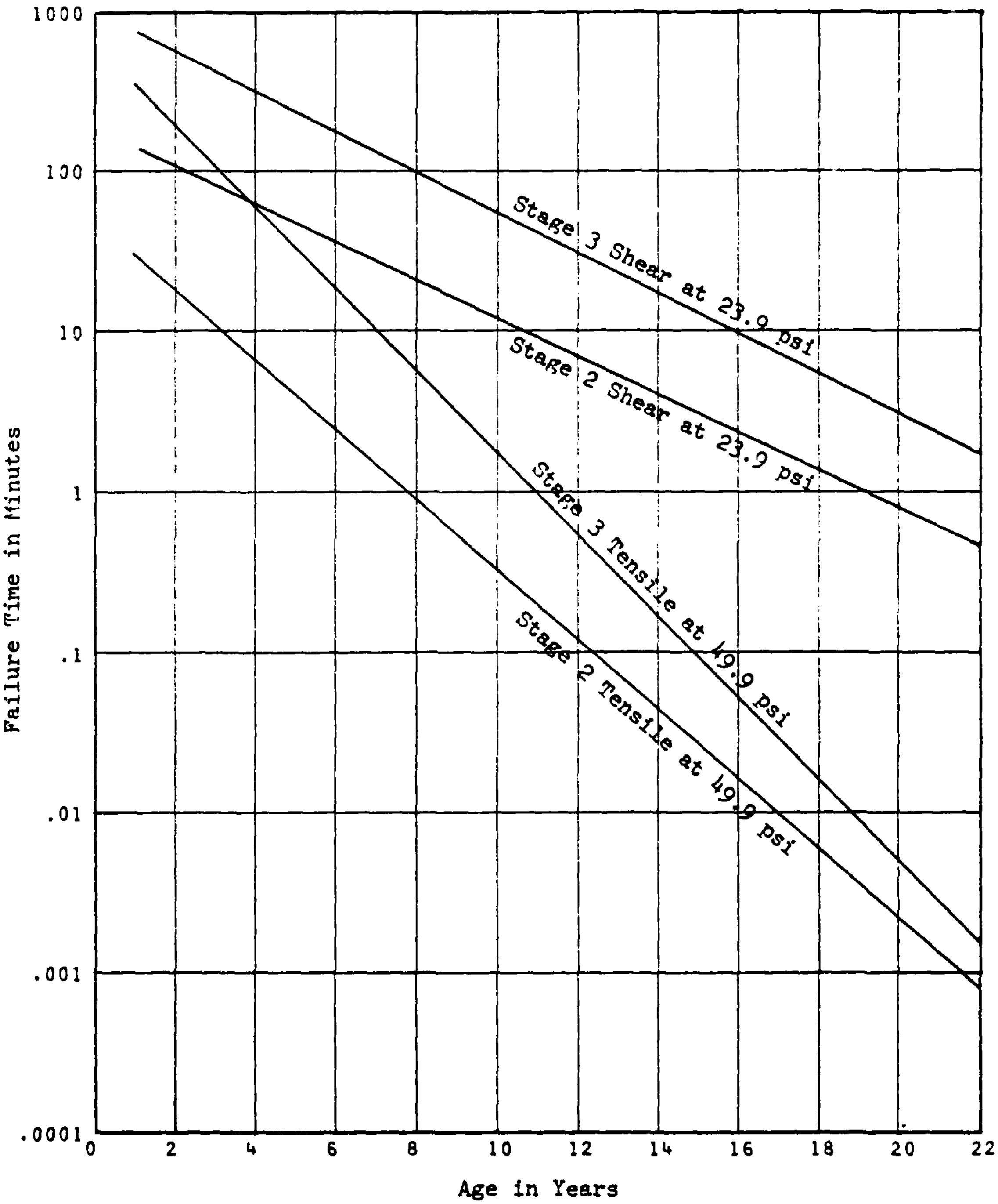


CHART 6. Fifty Percent Casebond Failure During Storage. Carton testing indicates a fifty percent probability of failure if the indicated psi alert load limits are sustained for the time corresponding to a selected age.

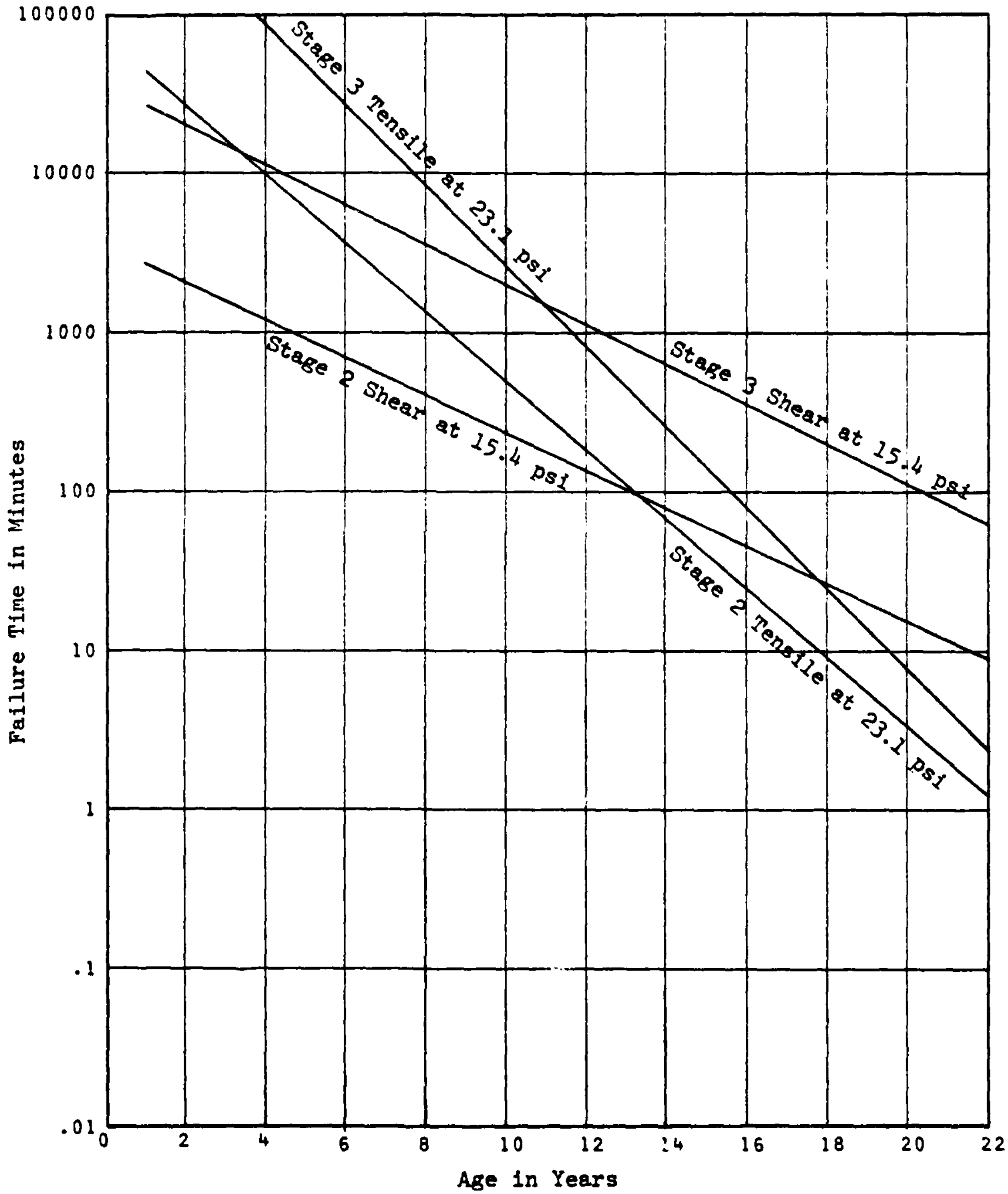


TABLE 8-8

ADDITIONAL STAGE II LINER BOND TEST DATA

Motor Number	Lot	Age (mo)	Swell Ratio		Gel Filler		*Mini-DPT Max Stress	*Mini-DPT Time to Max	Percent Insulation Moisture
AA21034	052G	82	2.019	2.034	.588		[2]51.91	[2].268	1.102
AA21048	052G	81	1.899	1.872	.500		53.62	.232	1.094
AA21057	053P	80	1.935	1.978	.515		[3]53.16	[3].409	1.057
AA21070	053P	80	1.720	1.700	.624		[2]67.38	[2].172	.985
AA21442	066P	45	1.621	1.739	.615		63.83	.047	1.059
AA21460	066P	42	1.726	1.696	.679		[3]95.64	[3].087	.879
AA21466	067P	41	1.792	1.806	.689		97.20	.118	1.030
AA21487	067P	37	1.617	1.699	.677		86.23	.065	1.145
AA21573	071P	21	1.616	1.581	.663		[3]83.02	[3].095	.974
AA21585	071P	19	1.756	1.701	.706		[3]85.48	[3].087	.894
AA21588	072P	19	1.723	1.698	.714		86.47	.128	.882
AA21590	072P	17	1.699	1.681	.696		80.49	.126	1.035
AA21086	051P	86	1.979	1.906	.612		60.39	.264	
AA21098	051P	84	1.710	1.647	.515		47.45	.351	
AA21121	055G	82	1.833	2.000	.553		42.74	.180	
AA21125	055G	82	1.920	1.855	.552		41.25	.209	
AA21201	057P	75	2.089	2.000	.573		49.60	.149	
AA21215	057P	74	1.886	1.835	.621		48.94	.199	
AA21260	059G	71	2.200	2.410	.408		20.97	.670	
AA21283	059G	70	1.747	1.671	.570		53.50	.490	
AA21295	060G	69	1.890	1.978	.549		47.59	.109	
AA21321	060G	67	2.120	2.320	.456		28.14	.064	
AA21310	061P	68	1.798	1.848	.564		45.68	.222	
AA21328	061P	66	1.942	2.000	.504		41.30	.366	
AA21083	054P	90	1.798	1.848	.622	.618	62.40	.188	1.504
AA21109	054P	88	1.942	2.000	.603	.624	46.31	.256	1.417
AA21179	058G	81	1.718	1.757	.589	.646	70.36	.096	1.165
AA21210	058G	79	1.820	1.832	.658	.633	56.42	.172	1.143
AA21333	062P	70	1.934	1.895	.647	.651	47.95	.397	1.343
AA21345	062P	69	1.905	1.743	.597	.678	52.68	.187	1.102
AA21363	063P	68	1.783	1.827	.562	.573	56.41	.239	1.097
AA21379	063P	62	1.875	1.901	.685	.686	57.33	.295	1.085
AA21499	068P	45	1.765	2.085	.670	.696	66.69	.337	.994
AA21516	068P	42	1.800	1.838	.692	.694	77.46	.122	1.129
AA21525	069P	40	1.770	1.778	.624	.636	57.29	.069	1.053
AA21547	069P	37	1.829	1.833	.606	.689	73.36	.074	1.053

* The mini-DPT data entries are means of four except as indicated by superscript.

TABLE 8-9

ADDITIONAL STAGE III LINER BOND TEST DATA

Motor Number	Age (mo)	Swell Ratio		Gel Filler		*Mini-DPT Max Stress	*Mini-DPT Time To Max	% Insulation Moisture	
7110013	82	1.813	1.828	.603	.620	67.90	.222	1.166	
7110051	80	1.942	1.805	.641	.755	69.51	.069	.889	
8190016	70	1.888	1.928	.625	.607	71.63	.075	.983	
8190038	69	1.910	1.840	.618	.581	65.58	.157	.995	
8210015	63	1.610	1.778	.627	.619	84.76	.065	1.031	
8210034	62	1.900	1.878	.637	.591	77.70	.052	.952	
8230008	54	1.782	1.714	.598	.657	94.75	.069	1.011	
8230017	54	1.717	1.762	.649	.645	75.38	.054	.899	
8250022	42	1.696	1.762	.635	.614	78.98	.062	.991	
8250037	40	1.634	1.810	.643	.659	84.45	.067	.976	
8270013	28	1.792	1.811	.661	.644	77.95	.054	1.138	
8270015	28	1.792	1.832	.628	.603	68.84	.084	.857	
7240043	90	1.830	1.821	.545	.565	32.09	.222	.907	.927
7240054	90	2.413	2.014	.510	.647	40.04	.265	.849	.805
7120013	86	1.683	1.699	.682	.694	85.19	.107	1.208	1.108
7120029	84	1.961	1.677	.623	.633	77.56	.222	.696	.698
8200014	74	1.757	1.844	.666	.686	76.24	.234	.994	1.069
8200023	73	1.845	1.743	.656	.636	78.99	.194	.948	.940
8220022	65	1.730	1.810	.723	.711	74.51	.162	1.078	.922
8220036	63	1.631	1.644	.619	.607	77.52	.174	.927	.955
8250013	50	1.527	1.722	.686	.689	83.09	.117	.964	.910
8250025	48	1.718	1.764	.663	.681	68.29	.184	1.102	1.028
8260007	44	1.717	1.674	.632	.674	75.60	.157	.915	.930
8260036	40	1.820	1.706	.674	.685	93.39	.102	.995	.997
7110013	95	1.739	1.736	.629	.613	71.92	.221	1.032	
7110040	94	1.830	1.920	.574	.583	65.91	.165	.941	
7130005	88	1.820	1.742	.681	.733	63.73	.138	1.050	
7130036	86	1.870	2.010	.588	.559	60.73	.256	.823	
8190006	85	1.857	1.913	.632	.606	61.10	.224	.950	
8190038	83	1.733	1.745	.625	.618	67.22	.154	.980	
8210003	77	1.615	1.606	.649	.687	81.94	.060		
8210019	76	1.768	1.800	.650	.644	75.26	.162	1.160	
8230002	68	1.785	1.776	.642	.634	74.32	.068		
8230028	66	1.788	1.760	.655	.644	88.88	.064		
8240023	62	1.918	1.927	.606	.534	87.12	.049	.990	
8240042	59	1.766	1.835	.679	.656	72.55	.074	1.811	

* The mini-DPT data entries are composed of means of four.

TABLE 8-10

REGRESSION ANALYSIS PARAMETERS FOR DATA OTHER THAN CONSTANT LOAD SHEAR OR CONSTANT LOAD TENSILE

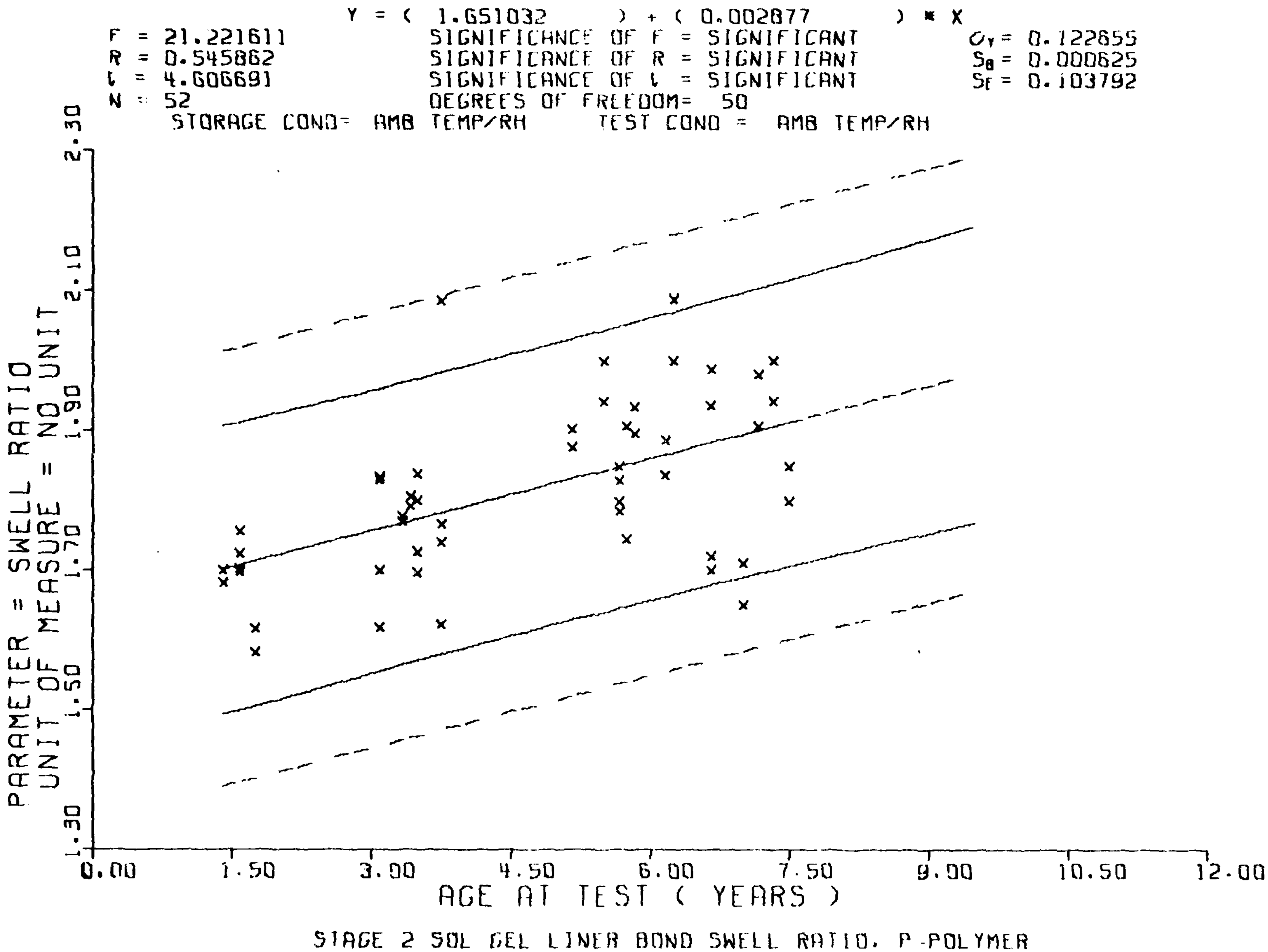
	Intercept	Slope	t	N	Sig.
Stage II					
Swell Ratio, G-polymer	2.909395	-.012626	1.82	20	NS
Swell Ratio, P-polymer	1.651032	.002877	4.61	52	S
Gel Filler, G-polymer	.032976	.006824	2.01	12	NS
Gel Filler, P-polymer	.725352	-.001583	4.58	36	S
Mini-DPT, Sm, G-polymer	40.322525	1.138383	1.64	10	NS
Mini-DPT, Sm, P-polymer	95.446258	-.540248	5.71	26	S
Mini-DPT, Time to Max, G	.790703	-.007090	0.68	10	NS
Mini-DPT, Time to Max, P	.026747	.002972	3.97	26	S
% Insulation Moisture, G	2.111999	-.012211	0.72	4	NS
% Insulation Moisture, P	.854690	.004330	3.78	20	S
Stage III					
Swell Ratio	1.665063	.001927	2.56	72	S
Gel Filler	.672911	-.000534	1.91	72	NS
Mini-DPT, Max Stress (Sm)	95.839019	-.330680	3.29	36	S
Mini-DPT, Time to Max	-.012176	.002168	4.15	36	S
% Insulation Moisture	1.066858	-.001165	0.88	45	NS

Note: S is significant and NS is not significant.

TABLE 10. ANALYSIS OF COVARIANCE RESULTS

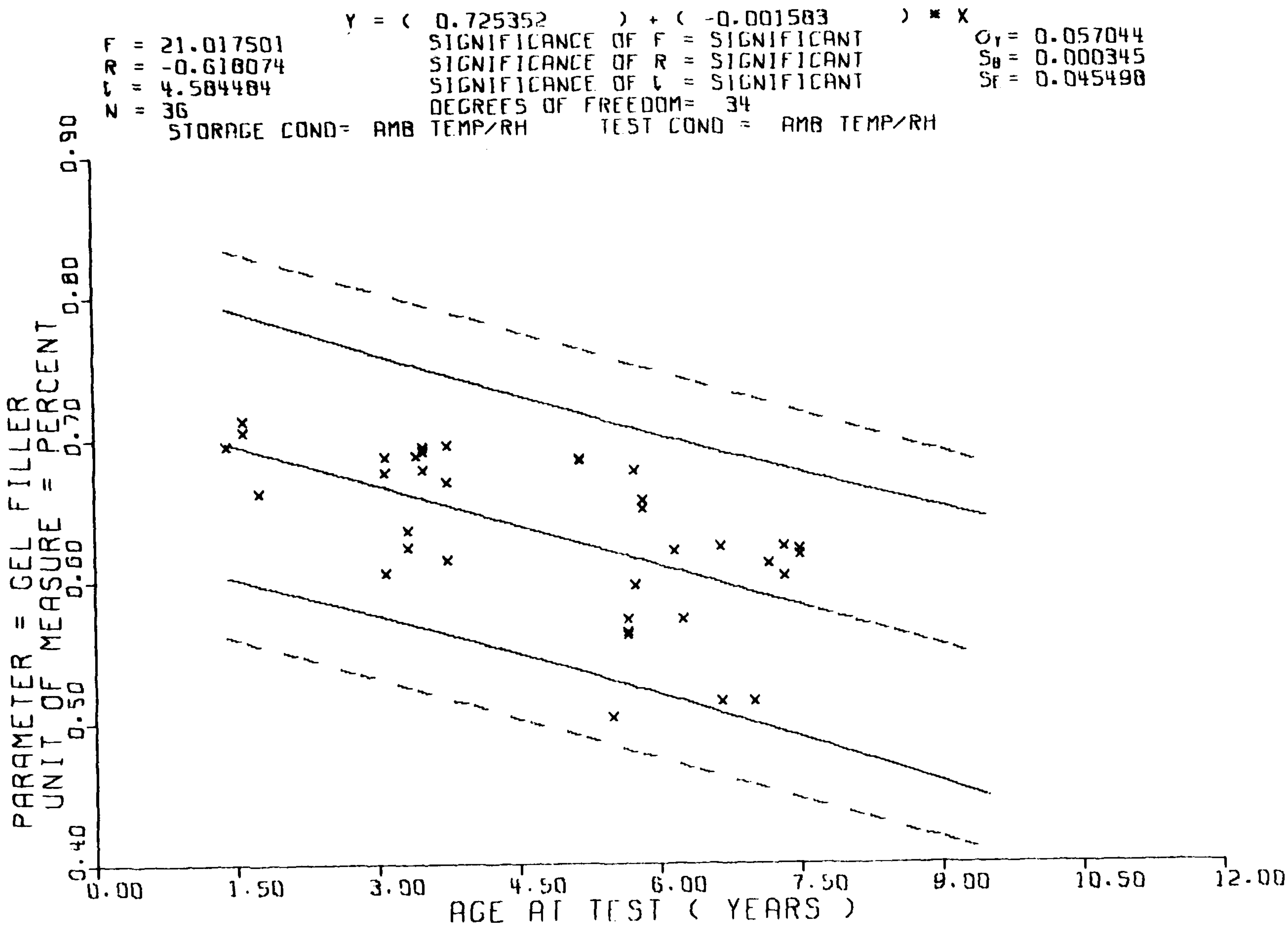
	Comparisons Between		
	Residual Variances	Trend Line Slopes	Trend Line Elevations
Stage 2 P-polymer vs Stage 3			
Swell Ratio	NS	NS	S
Gel Filler	NS	S	NS
Mini-DPT Maximum Stress	NS	NS	S
Mini-DPT Time to Max Stress	S	NS	S
% Insulation Moisture	NS	S	S
Stage 2 G-polymer vs P-polymer			
Swell Ratio	S	S	S
Gel Filler	NS	S	S
Mini-DPT Maximum Stress	NS	S	NS
Mini-DPT Time to Max Stress	S	NS	NS
% Insulation Moisture	NS	NS	NS

Note: S means significantly different and NS means not significantly different.



Y = (1.651032) + (0.002877) * X
F = 21.221611
R = 0.545862
t = 4.606691
N = 52
SIGNIFICANCE OF F = SIGNIFICANT
SIGNIFICANCE OF R = SIGNIFICANT
SIGNIFICANCE OF t = SIGNIFICANT
DEGREES OF FREEDOM= 50
σY = 0.122655
SB = 0.000625
SE = 0.103792
STORAGE COND= AMB TEMP/RH
TEST COND = AMB TEMP/RH
PARAMETER = SWELL RATIO
UNIT OF MEASURE = NO UNIT
2.30
2.10
1.90
1.70
1.50
1.30
0.00
1.50
3.00
4.50
6.00
7.50
9.00
10.50
12.00
AGE AT TEST (YEARS)
STAGE 2 SOL GEL LINER BOND SWELL RATIO, P-POLYMER

Figure 8-9

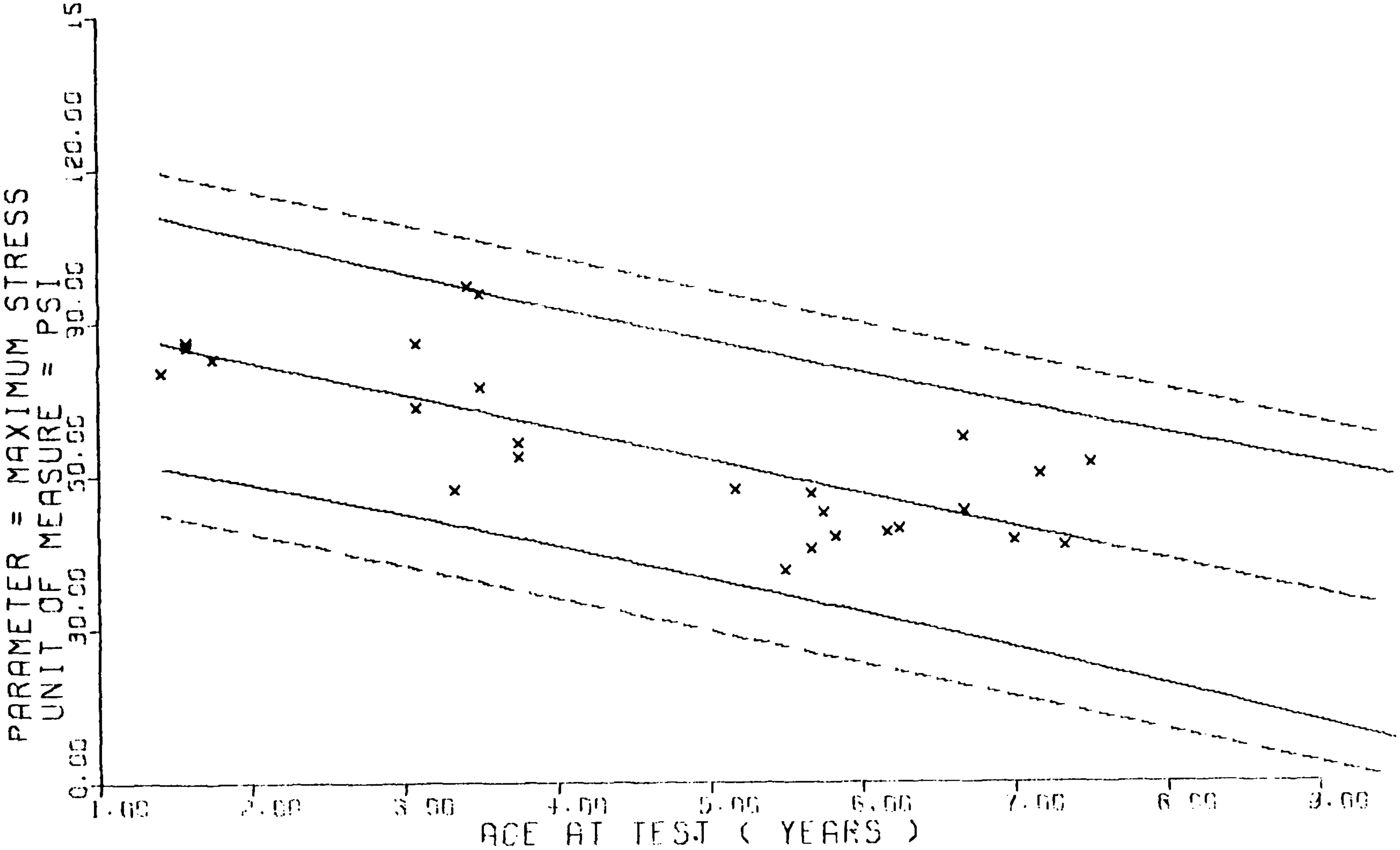


STAGE 2 SOL GEL LINER BOND GEL FILLER. P-POLYMER

Figure 8-10

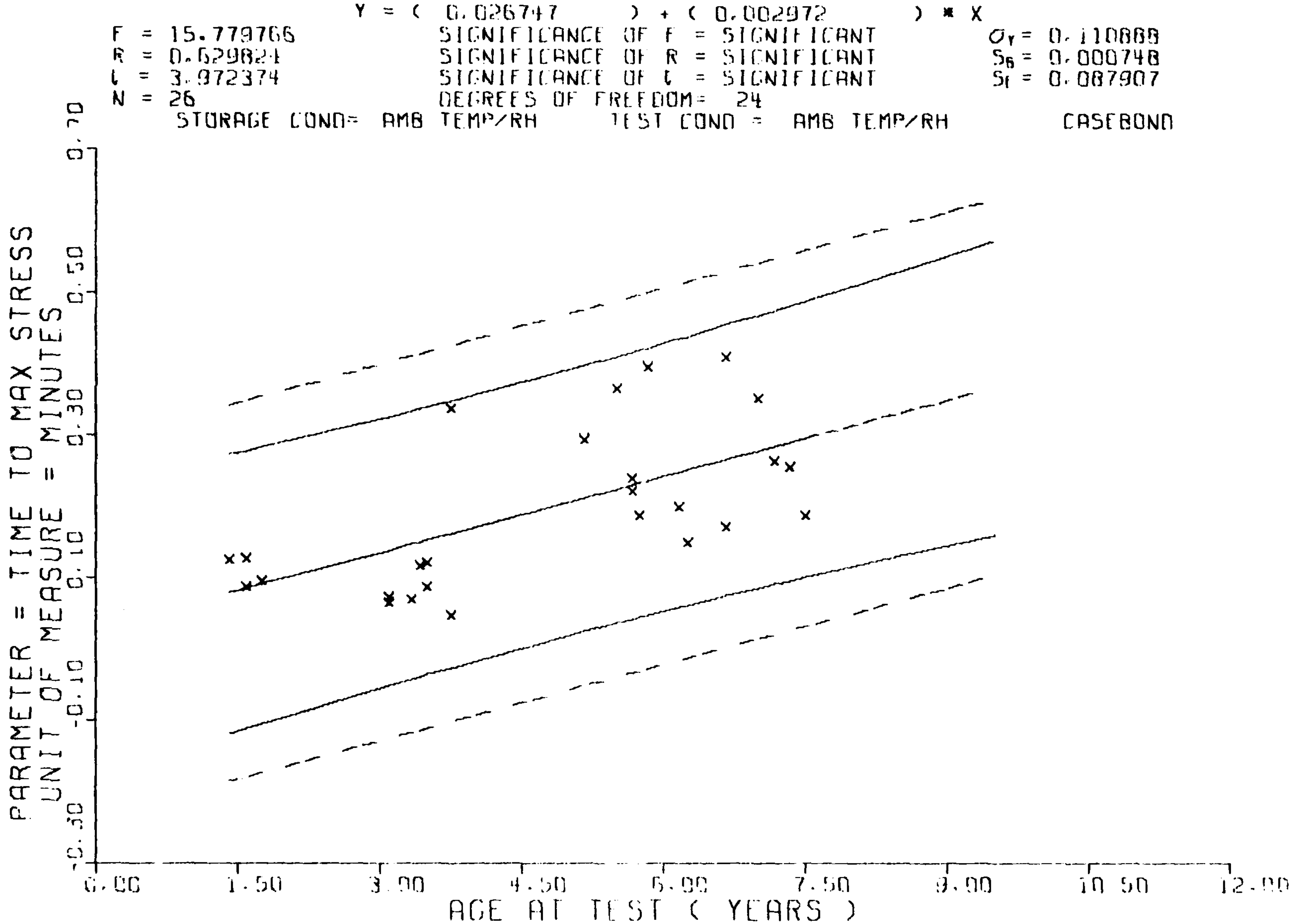
Y = (35.446258) + (-0.540248) * X

F = 32.605010 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = 15.720064
R = -0.758353 SIGNIFICANCE OF R = SIGNIFICANT S_B = 0.094613
L = 5.710070 SIGNIFICANCE OF L = SIGNIFICANT S_F = 11.117583
N = 26 DEGREES OF FREEDOM= 24
STORAGE COND= AMB TEMP/RH TEST COND = AMB TEMP/RH CASEBOND



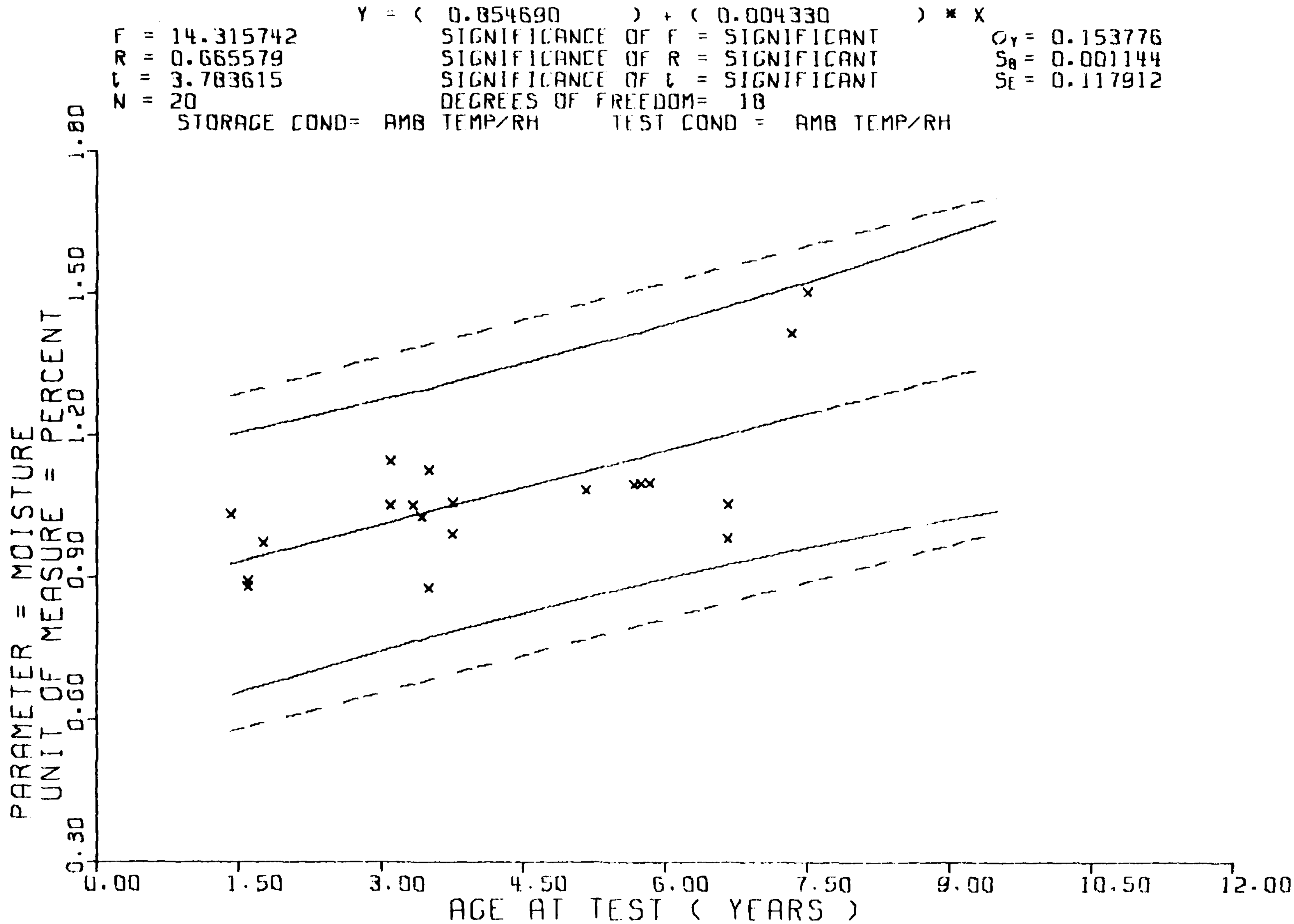
STAGE 2 MINI-DFT MAXIMUM STRESS, P-POLYMER

Figure 8-11



STAGE 2 MINI-OPT TIME TO MAX STRESS. P-POLYMER

Figure 8-12

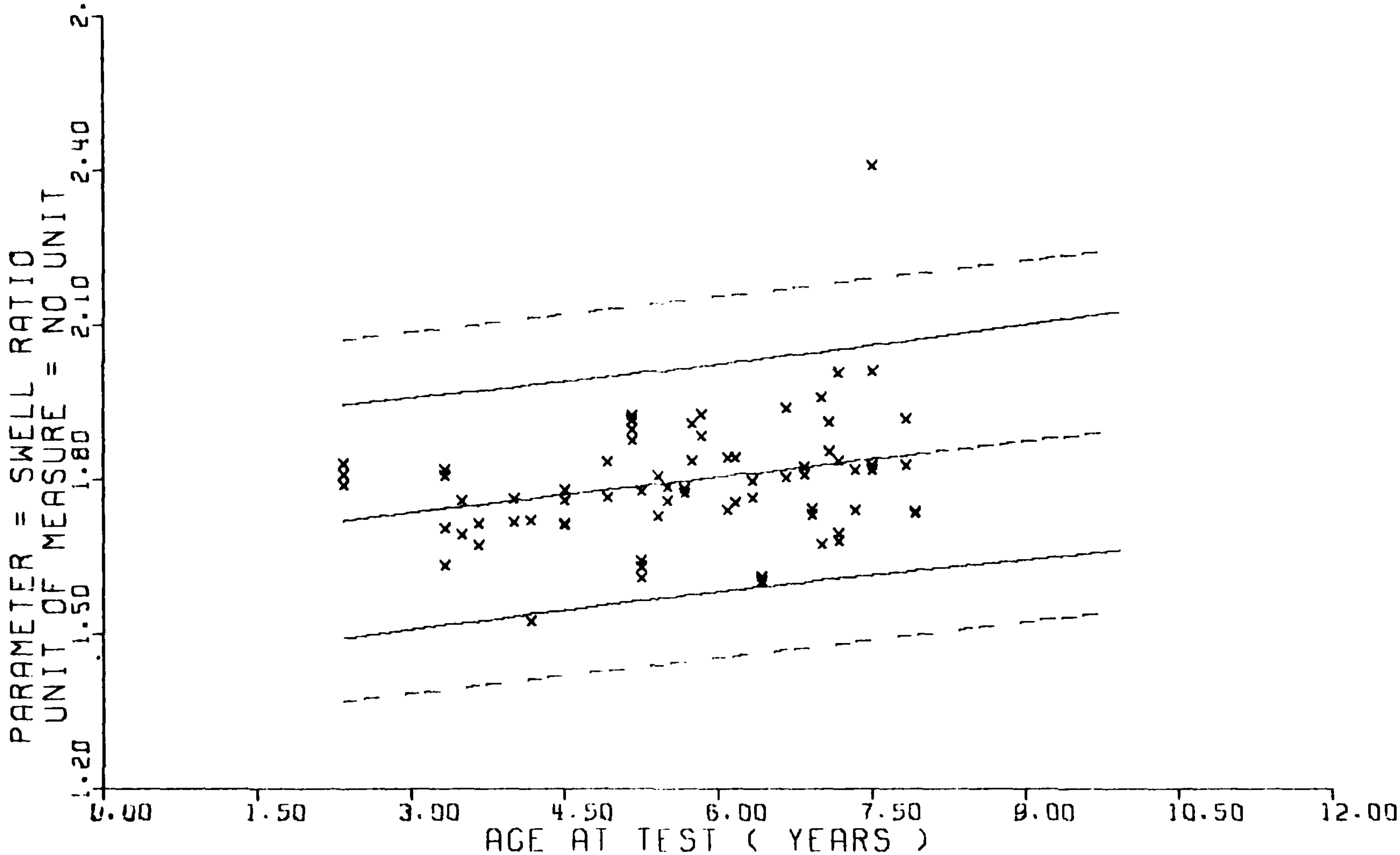


STAGE 2 LINER BOND INSULATION MOISTURE, P-POLYMER

Figure 8-13

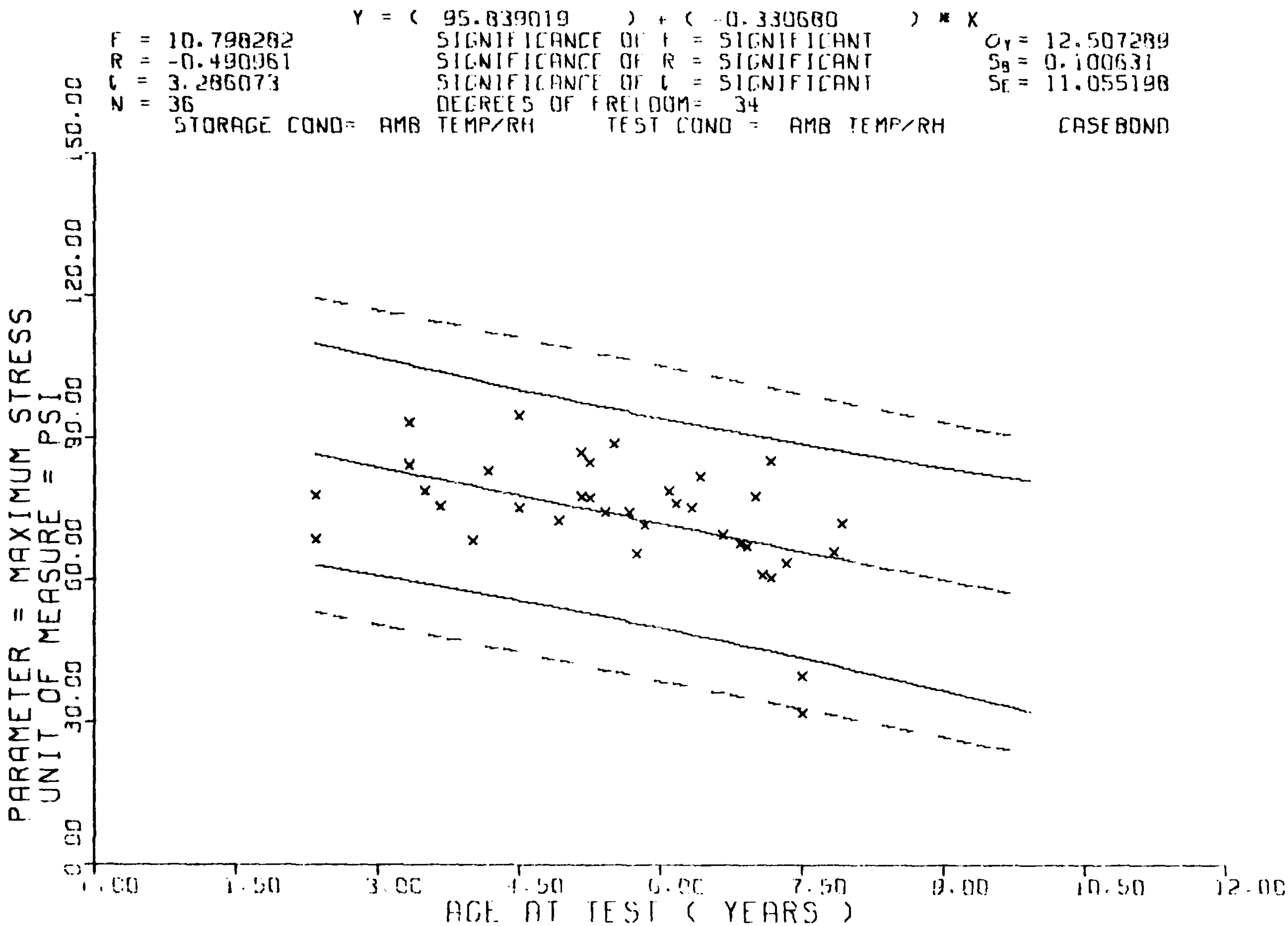
Y = (1.665063) + (0.001927) * X

F = 6.558958 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = 0.121383
R = 0.292698 SIGNIFICANCE OF R = SIGNIFICANT S_B = 0.000752
t = 2.561045 SIGNIFICANCE OF t = SIGNIFICANT S_F = 0.116893
N = 72 DEGREES OF FREEDOM= 70
STORAGE COND= AMB TEMP/RH TEST COND = AMB TEMP/RH



STAGE 3 LINER BOND SOL GEL SWELL RATIO

Figure 8-14



STAGE 3 MINI OPT MAXIMUM STRESS

Figure 8-15

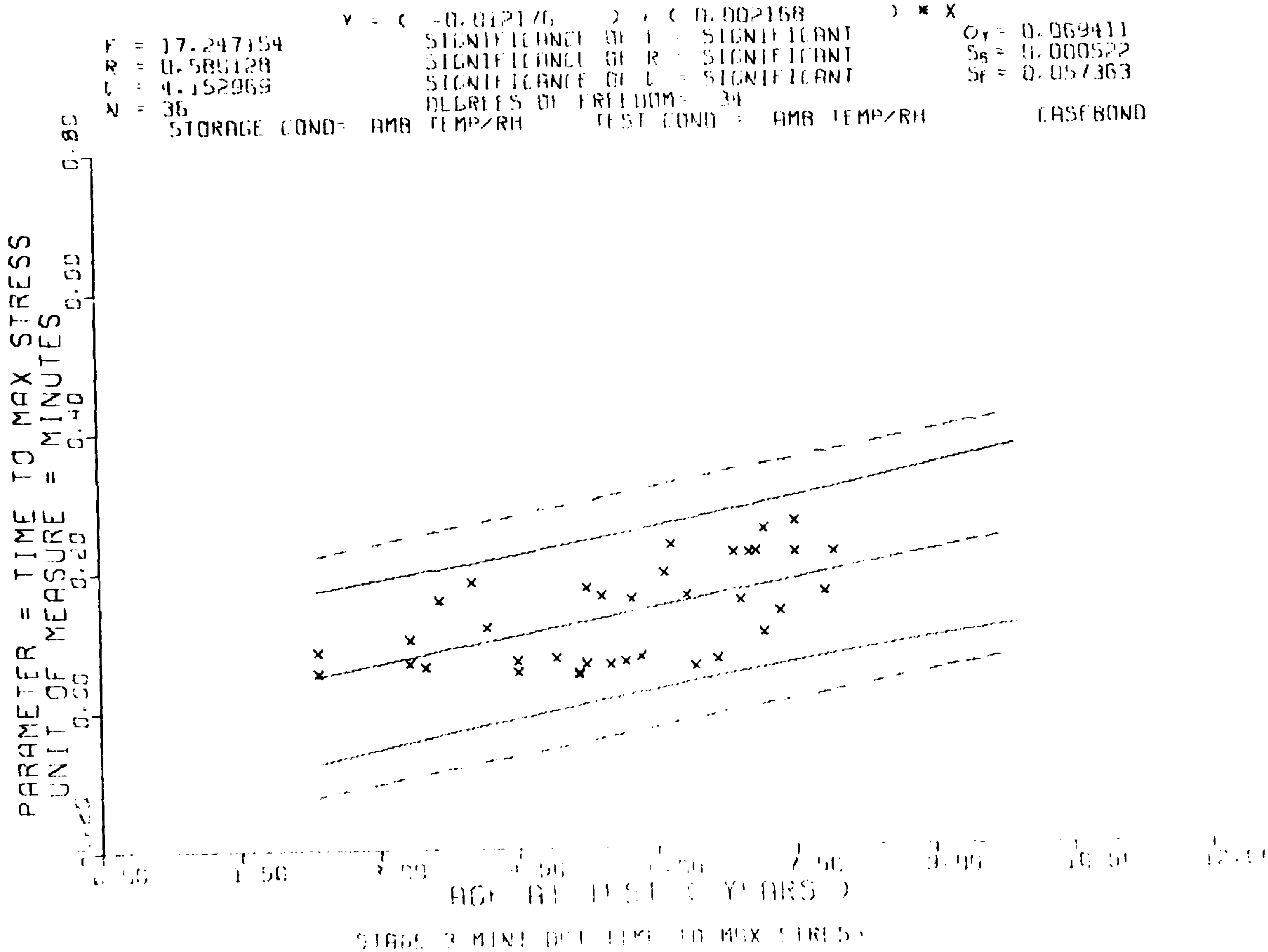

Y = (-0.012176) + (0.002168) * X
F = 17.247154
R = 0.585128
L = 4.152969
N = 36
SIGNIFICANCE OF F = SIGNIFICANT
SIGNIFICANCE OF R = SIGNIFICANT
SIGNIFICANCE OF L = SIGNIFICANT
DEGREES OF FREEDOM = 34
STORAGE COND= AMB TEMP/RH
TEST COND = AMB TEMP/RH
CASEBOND
PARAMETER = TIME TO MAX STRESS
UNIT OF MEASURE = MINUTES
0.80
0.60
0.40
0.20
0.00
AGE AT TEST (YEARS)

Figure 8-16

SECTION IX

HARDNESS

Shore A durometer readings are taken on dogbone ends prior to tensile testing. The 10 second readings are considered to be more accurate.

There is a significant increase in hardness for all three types of lined cartons (Figures 9-4 to 9-6) and for ANB P unlined cartons (figure 9-2).

TABLE 9-1

HARDNESS

Significance of Regression Slopes

System	Shore A 10 sec	Figure
ANB G Unlined	Sig dec	9-1
ANB P Unlined	Sig inc	9-2
ANT P Unlined	Sig dec	9-3
ANB G Lined	Sig inc	9-4
ANB P Lined	Sig inc	9-5
ANT P Lined	Sig inc	9-6

TABLE 9-2

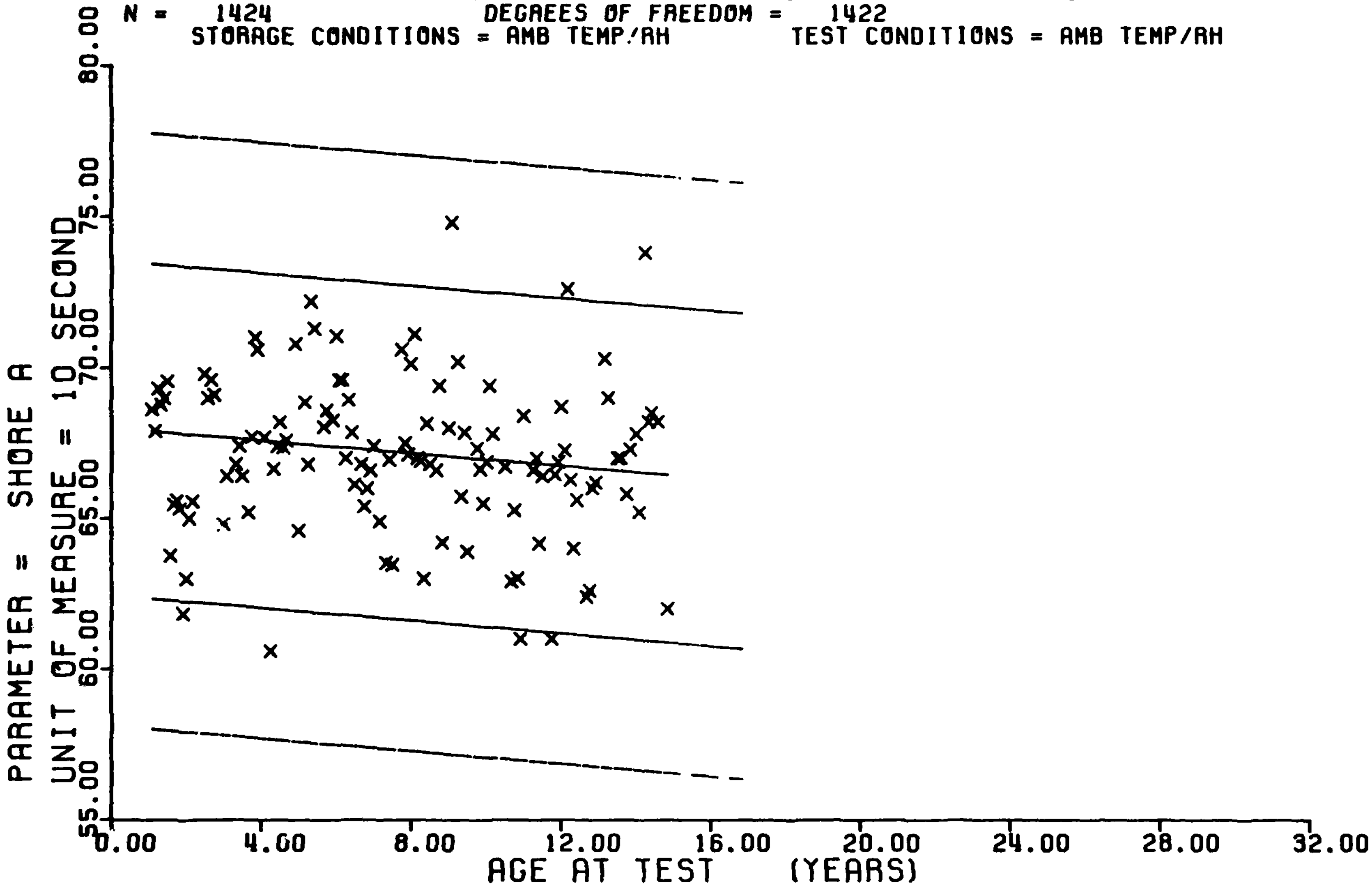
ANALYSIS OF COVARIANCE COMPARISON OF REGRESSIONS
SHORE A 10 SECOND HARDNESS

		Sig
Lined Vs Unlined		
ANB P-polymer	Residual Variance	S
	Slope	S
	Elevation	S
ANB G-polymer	Residual Variance	S
	Slope	S
	Elevation	S
ANT P-polymer	Residual Variance	S
	Slope	NS
	Elevation	NS
ANB P Unlined Vs Ant P Lined	Residual Variance	S
	Slope	S
	Elevation	S
G-polymer Vs P-polymer		
ANB Lined	Residual Variance	NS
	Slope	S
	Elevation	S
ANB Unlined	Residual Variance	S
	Slope	S
	Elevation	S
ANB G Unlined Vs ANT P Unlined	Residual Variance	NS
	Slope	NS
	Elevation	S
ANB G Lined Vs ANT P Lined	Residual Variance	NS
	Slope	S
	Elevation	S
ANB P-polymer Vs ANT P-polymer		
Lined	Residual Variance	S
	Slope	NS
	Elevation	S
Unlined	Residual Variance	S
	Slope	S
	Elevation	S

NOTE: S means a significant difference and NS means not significant.

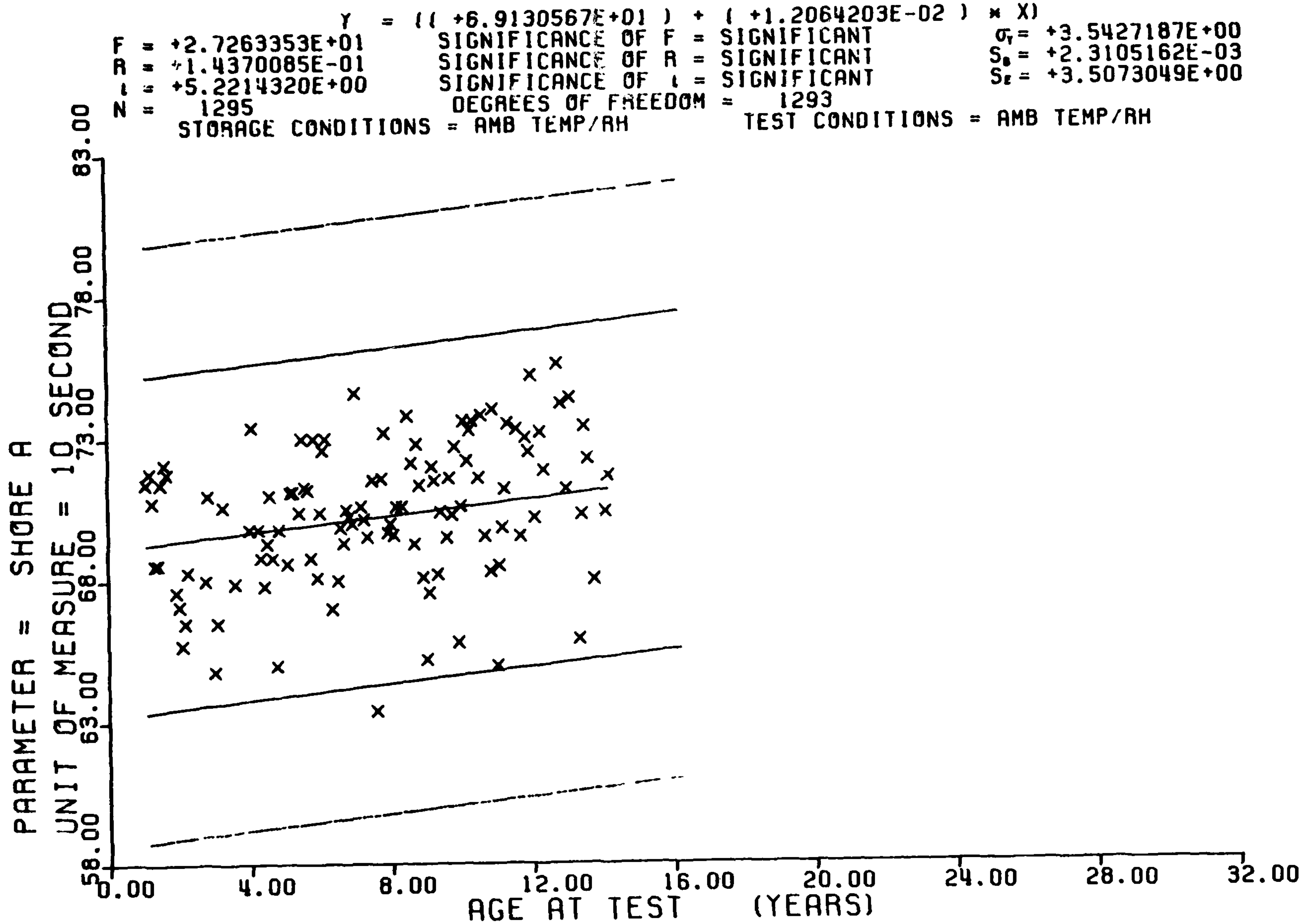
Y = ((+6.8005889E+01) + (-8.7614122E-03) * X)

F = +2.0141321E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +3.3151969E+00
R = -1.1817893E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +1.9522261E-03
ι = +4.4879083E+00 SIGNIFICANCE OF ι = SIGNIFICANT S_E = +3.2931223E+00
N = 1424 DEGREES OF FREEDOM = 1422
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



SHORE A 10 SEC HARDNESS, ANB-3066 (ANB G UNLINED)

Figure 9-1



SHORE A 10 SEC HARDNESS, ANB-3066 (ANB P UNLINED)

Figure 9-2

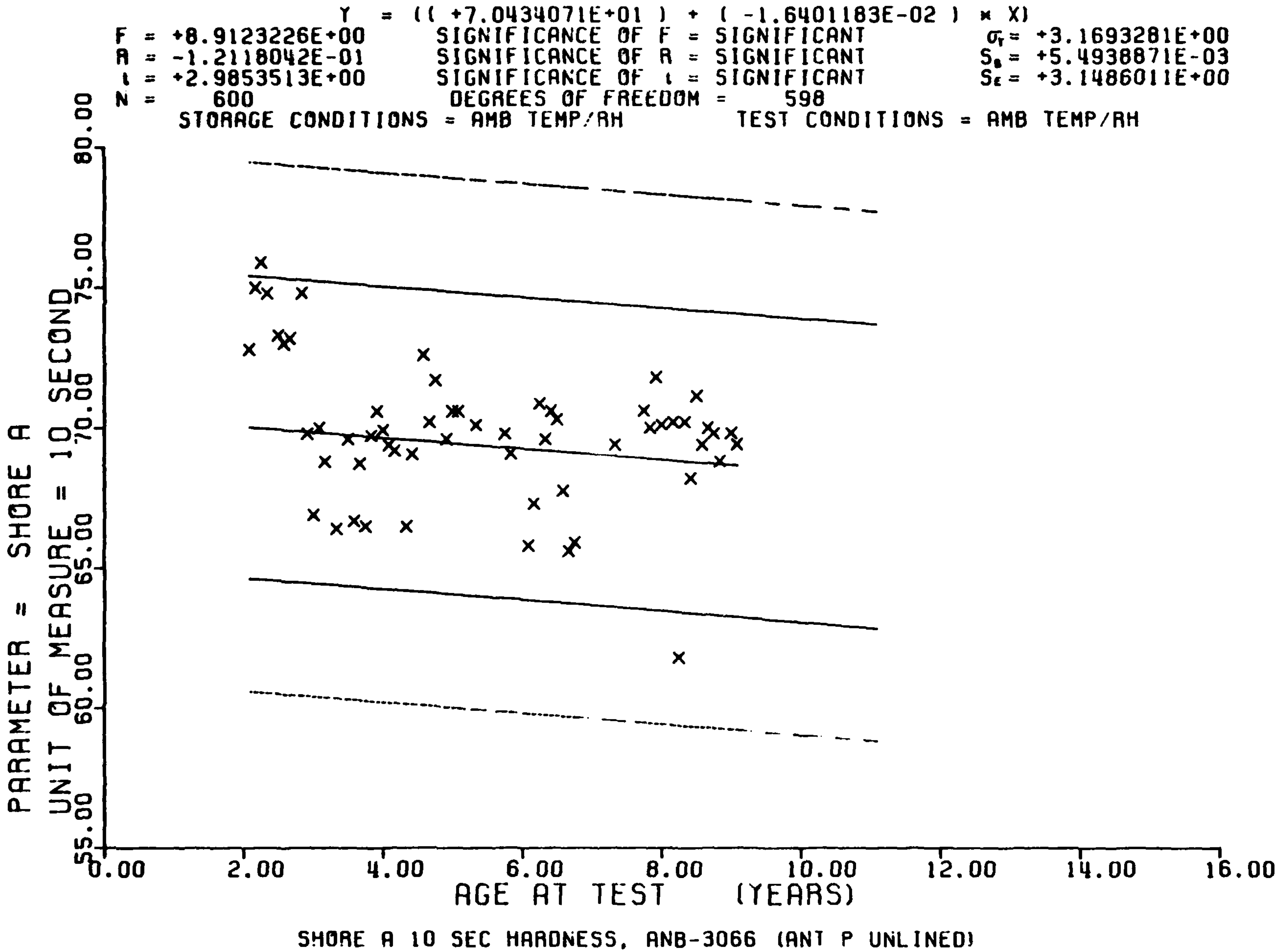
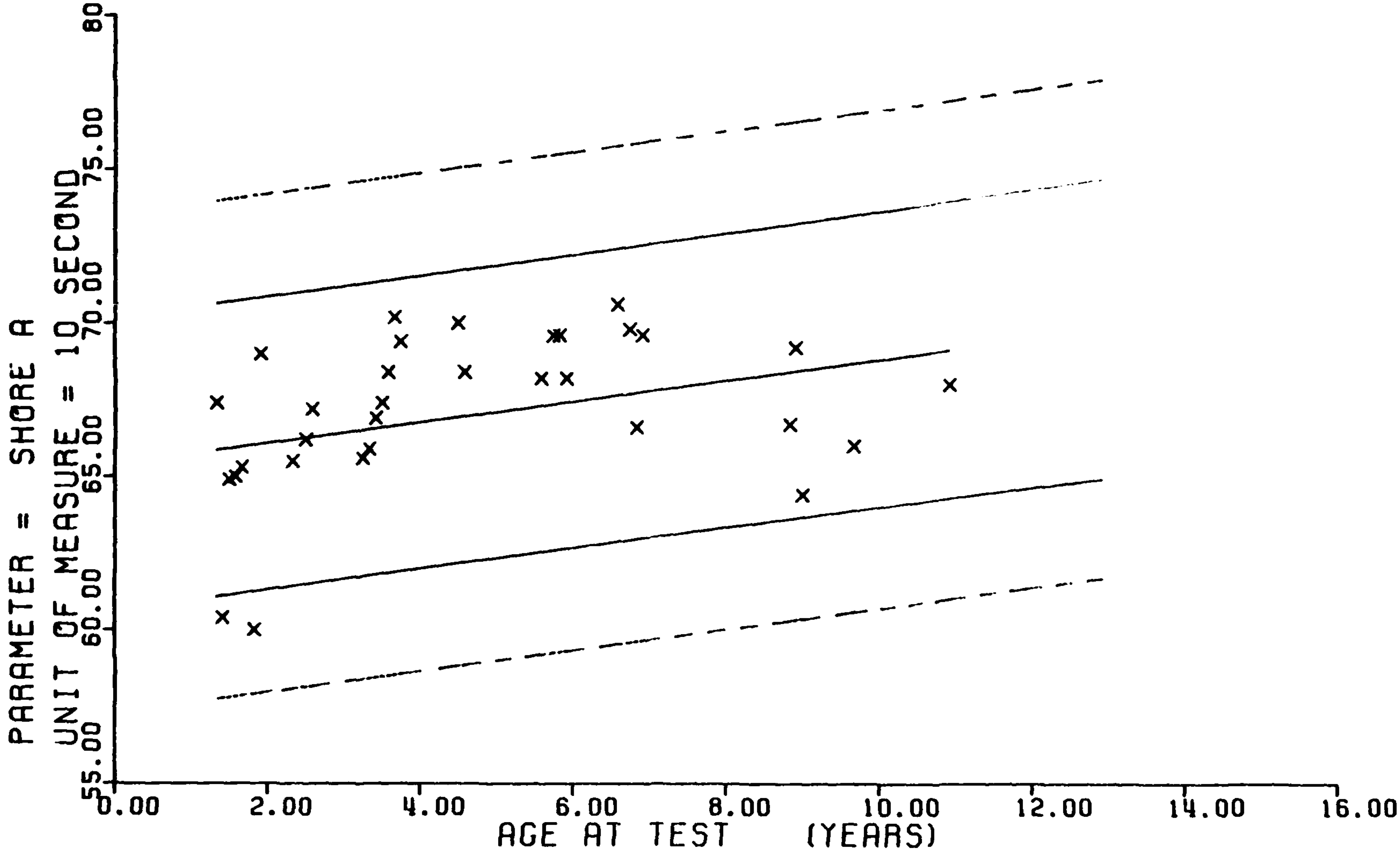

Y = ((+7.0434071E+01) + (-1.6401183E-02) × X)
F = +8.9123226E+00 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +3.1693281E+00
R = -1.2118042E-01 SIGNIFICANCE OF R = SIGNIFICANT S_b = +5.4938871E-03
t = +2.9853513E+00 SIGNIFICANCE OF t = SIGNIFICANT S_ε = +3.1486011E+00
N = 600 DEGREES OF FREEDOM = 598
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = SHORE A
UNIT OF MEASURE = 10 SECOND
80.00
75.00
70.00
65.00
60.00
55.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
AGE AT TEST (YEARS)
SHORE A 10 SEC HARDNESS, ANB-3066 (ANT P UNLINED)

Figure 9-3

$Y = ((+6.5402572E+01) + (+2.8394734E-02) * X)$

F = +2.3899309E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_T = +2.8466187E+00
R = +3.1762214E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +5.8082479E-03
t = +4.8886919E+00 SIGNIFICANCE OF t = SIGNIFICANT S_E = +2.7055421E+00
N = 215 DEGREES OF FREEDOM = 213
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



SHORE A 10 SEC HARDNESS, ANB-3066 (ANB G LINED)

Figure 9-4

Y = ((+6.5221787E+01) + (+5.3362069E-02) * X)

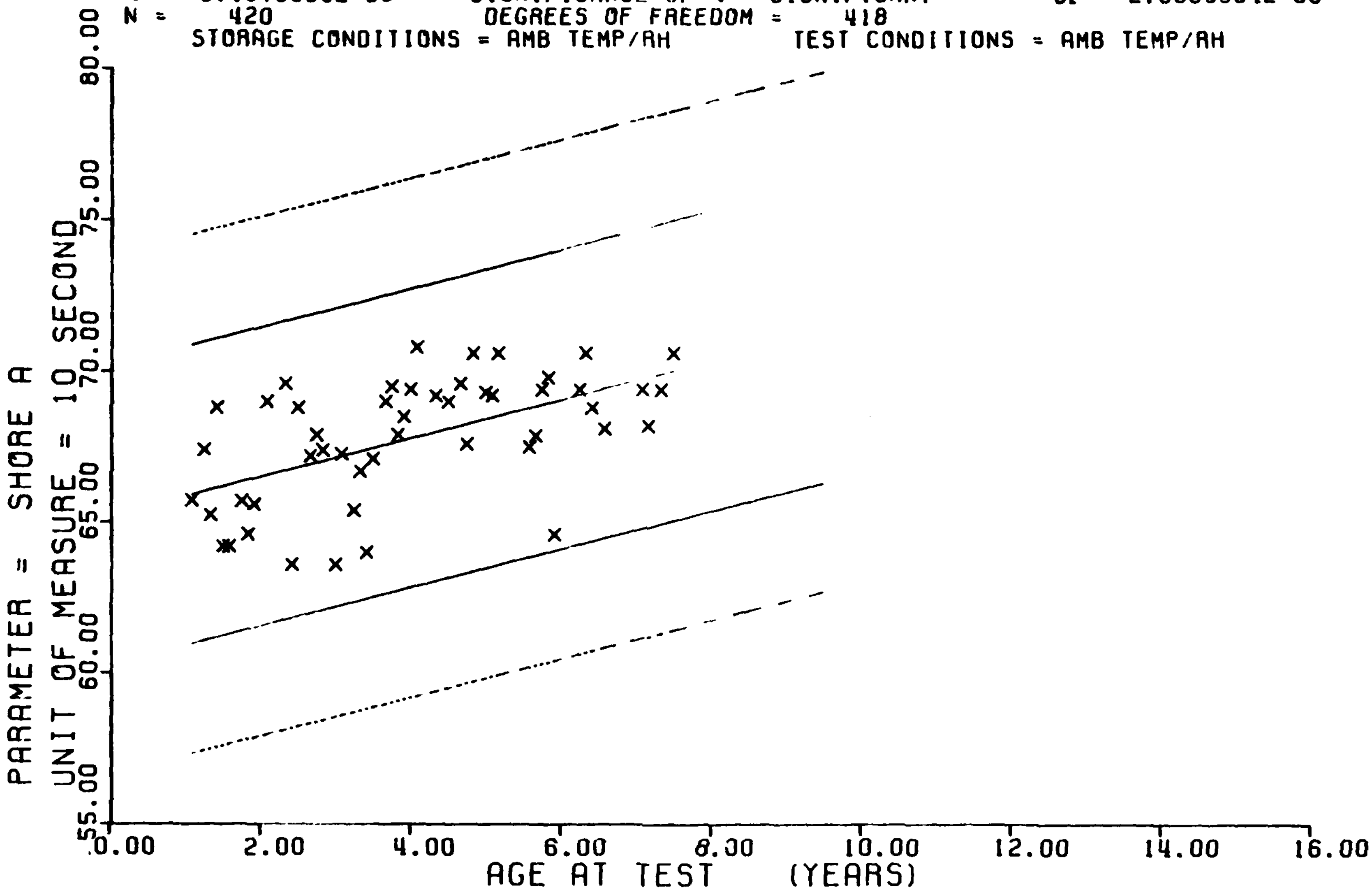
F = +6.6706391E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +3.0831738E+00

R = +3.7097474E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +6.5335458E-03

ι = +8.1673980E+00 SIGNIFICANCE OF ι = SIGNIFICANT S_E = +2.8665904E+00

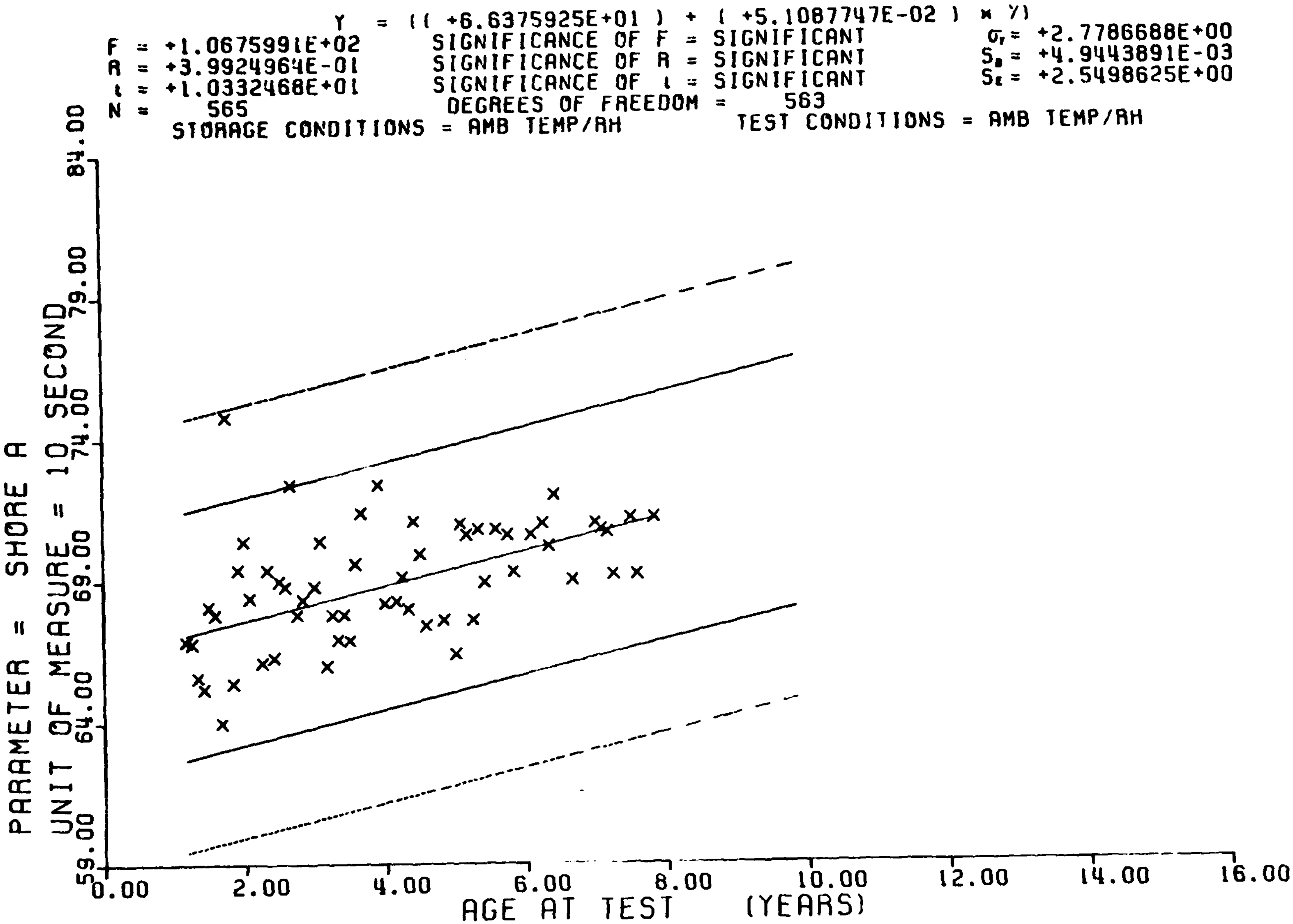
N = 420 DEGREES OF FREEDOM = 418

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



SHORE A 10 SEC HARDNESS, ANB-3066 (ANB P LINED)

Figure 9-5



SHORE A 10 SEC HARDNESS, ANB-3066 (ANT P LINED)

Figure 9-6

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report contains test results from LGM-30 F and G, Stage II and Stage III propellant. Data are shown in regression plots, special types of plots such as those of gradient stress relaxation and constant loas testing. Occasionally, data are presented in Tabular form.

The differences between polymers used in the propellant are given in the analysis of covariance tables. Graphically, the differences are most evident in gradient stress relaxation modulus.